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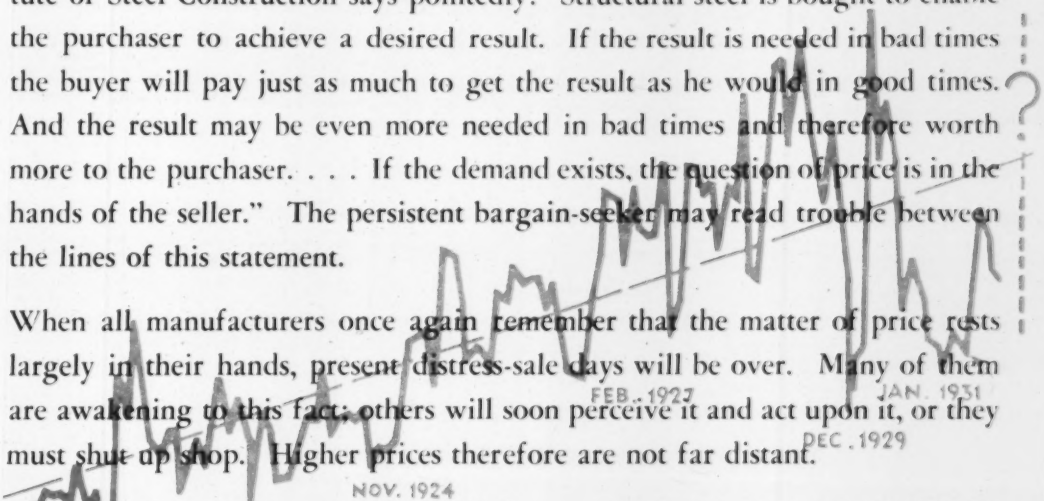
Engineering News-Record

Bargain Days

Manufacturers are about fed up on low prices. Apparently there is a limit to the degree to which an industry will demoralize itself by selling for cost or less than cost. There are straws in the wind that indicate the development of a concerted resistance to a further lowering of prices. The American Institute of Steel Construction says pointedly: "Structural steel is bought to enable the purchaser to achieve a desired result. If the result is needed in bad times the buyer will pay just as much to get the result as he would in good times. And the result may be even more needed in bad times and therefore worth more to the purchaser. . . . If the demand exists, the question of price is in the hands of the seller." The persistent bargain-seeker may read trouble between the lines of this statement.



When all manufacturers once again remember that the matter of price rests largely in their hands, present distress-sale days will be over. Many of them are awakening to this fact; others will soon perceive it and act upon it, or they must shut up shop. Higher prices therefore are not far distant.

If construction history repeats itself, the construction-volume curve will rise suddenly and precipitously. Equipment and materials will be required in large quantities. Demand will exceed supply. And the seller will again make the prices.

And the seller deserves higher prices. The general prosperity requires that he soon receive them. Numerous factors are now at work to restore them.

Wise constructors who can foresee their needs for the business pick-up are doing their buying now. They know that bargain days are nearly over.

August 27, 1931

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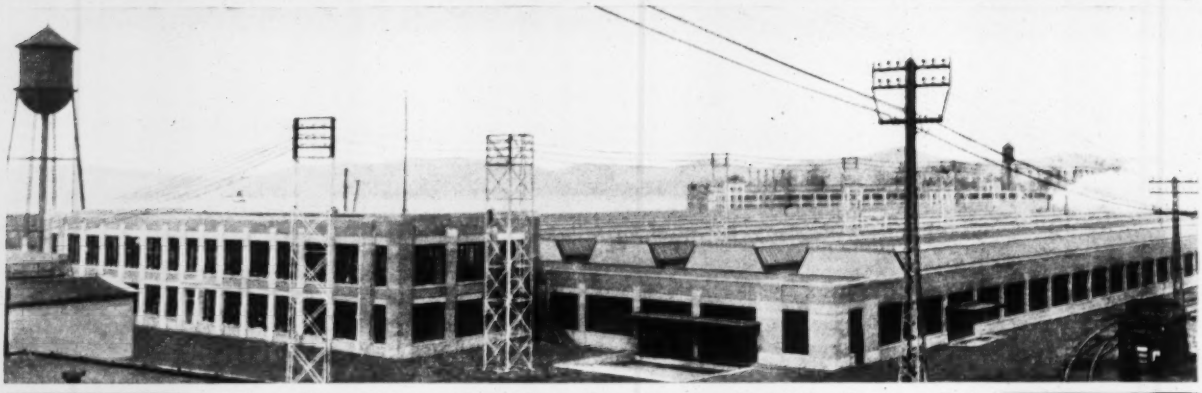

Chevrolet Motors, Division of General Motors Corporation, Assembly Building, Tarrytown, N. Y., covered with over 400,000 sq. ft. of Featherweight Concrete Insulating Roof Slabs. Many other plants of this Company from New York to California are protected with Federal. Architects: Albert Kahn, Inc.

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ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL OF CIVIL ENGINEERING AND CONSTRUCTION PRACTICE

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F. E. Schmitt, Editor

AUGUST 27, 1931

No Shovels Yet

MUCH is being said at the present time about starting the St. Lawrence ship canal and power project as a way of providing for unemployment relief and of stimulating trade through the placing of large orders for construction materials. The chairman of New York's power authority visualizes the start of the Massena Point power plant before the end of the year with thousands of men put to work. The construction industry will do well not to put too much faith in such optimistic predictions. No treaty has been signed, no detailed plans have been made and, in so far as New York's power scheme is concerned, no contract for power has been made, an essential requirement for the financing of construction. Nor can construction of the ship canal project start without the conclusion of a treaty with Canada. No treaty negotiations are under way for the reason that the Canadians are disgusted over the way our Senate handled the Niagara remedial treaty matter. The Canadian government is through with treaty commissioners and wants the St. Lawrence canal matter handled through diplomatic channels, with the American government taking the lead. Congress does not meet until December. Even though the subject came up early in the session there are too many complications and too much opposition to the project to expect definite action until after a protracted fight. No dirt will fly along the St. Lawrence this winter. That is not the place to look for a job or for a sale of construction equipment or materials.

Expediting Municipal Works

MUNICIPAL public works can be made a greater factor in easing the present unemployment by eliminating the procrastination and delay that hamper their planning. Many delays can be combated by public record of their progress through the routine stages from initiation to authorization and construction. The public, including the engineer as a citizen, knows little of the prescribed routine or of the formalities attending the preliminary stages of improvement projects. Correspondingly, public knowledge can reduce red tape and delay due to clerical routine. But it can do more than this. If the citizen is fully informed on how municipal projects originate, through what stages they must pass, and what organizations, committees, departments or bureaus are required to authorize and appropriate, he will learn more definitely where and how procrastination enters the process and how it can be reduced. The influences that oppose projects will become more evident. Opposition based on legitimate grounds or a misunderstanding of the situation can be dealt with promptly by direct methods, while opposition based on political or personal grounds will appear in its true light and can be fought. Legal safeguards to insure honesty and efficiency in work and expenditures need not be relaxed, but obstruction and unnecessary delay can be reduced. Just now, when unemployment threatens an emergency, elimination of delay is of highest value.

Public-Spirited Engineers

THE Cleveland Engineering Society has recently had an opportunity to show what a valuable service can be given the community by an organization of engineers. Cleveland holds its engineers and their society in high regard, an attitude that has been both demonstrated and intensified by recent events. In planning a long viaduct over the Cuyahoga River valley the authorities were divided on the location of the eastern approach. The commissioners of Cuyahoga County, under whose auspices the bridge is to be built, requested the Regional Planning Division of the society to examine the merits of the two proposed plans and to make a recommendation as to the one to be chosen. In less than two weeks the committee appointed had interviewed the principal engineers and laymen specially interested in the improvement, had had its recommendation approved by the trustees of the society, and had submitted its report to the authorities. A subsequent request by the county for a bill for the service was declined. Since much of the work of civil engineers is of direct social import it is not surprising that they should display in a marked degree a desire to be of public service. It is most gratifying that the officials in direct control of the public business of Cuyahoga County show that they appreciate the significance of that public spirit and the value of the service the engineers can render.

Two-Level Traffic

AWARD of a contract for the third of four sections in New York City's elevated vehicular roadway along the west side of Manhattan Island gives assurance that before long the city will be using a high-speed traffic artery for passenger vehicles which passes over the highly congested midtown section. Traffic experts are watching the experiment with considerable interest, for the project has aroused, since its inception, both commendation and criticism. Results secured with the lower third of the highway, which has been in service for almost a year, give a preliminary forecast of its usefulness. Traffic along the roadway is expedited—motorists report a trip of from three to five minutes in place of the former requirement of ten to twenty minutes or more, depending upon the time of day. With the completion of the entire length of 4½ miles the saving in time will be even more impressive. Other results, however, are less easy to evaluate. Congestion in parallel streets has not been appreciably lessened, with the possible exception of West Street, upon which the structure is built. Interference

of columns and footings with free movement on the street surface has not been serious, as some critics expected. The reduction in light and air on this thoroughfare is a minor consideration because of its unusual width and because it has long been dedicated to purely commercial uses. Accidents on the highway itself have been almost non-existent. Whether the saving in time for a limited class of vehicles justifies the total cost of $16,000,000 is a matter still in dispute, but the popularity with the motoring public of even the short section now in use cannot be denied.

Notable Drainage Work

NOVELTY in the drainage system for the Selfridge flying field described in this issue lies chiefly in the panel arrangement of collectors and carriers, which gives short, shallow tile runs for groundwater and long ditch runs for trench excavators. The article leaves little that needs to be said further in argument for the panel design as compared with the common rectangular and herringbone arrangements of the drain tile system. It has satisfied very perfectly the groundwater conditions at the Michigan flying field. In particular it permitted a more extensive and uninterrupted use of mechanical equipment than is ordinarily practicable. Except in the actual placing of the drain tile, virtually no hand work was employed, and machine work was so coordinated that major tasks of ditching and backfilling required no rehandling of earth and little idle travel of excavators and trucks. A part of the credit for this accomplishment is due the construction organization, but a part also is deserved by the panel design itself, which as worked out at Selfridge field is new.

Reducing Sewage Pollution

CITY sewage may be converted into good water, as has been demonstrated at the experimental sewage-treatment plant in Los Angeles, but there is little present need in this country for direct use of the sewage water. Yet "complete" treatment of sewage is progressing. Los Angeles is studying the matter because of the scarcity and high cost of water in that region. At Barrington, N. J., a suburb of Camden, treatment is being carried to a high degree to prevent pollution of a small brook into which the treatment plant discharges its effluent. Treatment is not carried as far as is done in the Los Angeles experimental plant, but it has been carried beyond the limits of most plants now in operation. The future will see an increasing need for such high-degree treatment. Karl Imhoff, in his discussion of the water-sewage-water cycle published in our issue of May 28, pointed out the extent to which sewage actually is being re-used in Europe. Only in a few regions are we in this country approaching such a condition, but a demand for a higher degree of treatment is developing, in the effort to reduce the pollution of streams in thickly populated districts.

Noise Abatement

THAT city noise is an economic evil, a nuisance and a detriment to physical and mental welfare is generally recognized. Steps already taken in some large cities indicate that it will receive increasingly active public attention. These steps include both general attacks upon sources of noise and—what is better—scientific investigation of its causes and practicable means of abatement. Prof. F. R. Watson, who reviews the situation this week, is qualified by long experience and study in the field of sound conveyance and control; his work on interior noise, or the acoustics of buildings, has been described previously (*ENR*, Jan. 16, 1930, p. 105). He makes a good point in referring to the quiet but powerful automobile. Imagine a street full of rattling and clanking automobiles and think of the public wrath soon aroused! But we do not yet have noiseless street cars, though a few have been designed. The direct relation of the engineer's construction work to the noise evil and the consequent desirability of his seeking to abate it was noted by us on repeated occasions (see *ENR*, July 24, Aug. 7 and Oct. 16, 1930, pp. 123, 197 and 598). Scientific investigation, however, must be supplemented by active and aggressive methods for putting noise reduction into practice. An example of what may be accomplished is the treatment of the smoke evil, already being dealt with in many cities. Here the successful results are due to intelligent investigation, accompanied by action to secure the cooperation of those responsible for the evil and followed by prompt introduction of remedial measures. But it must not be forgotten that the time to begin this campaign is before public opinion is aroused to such a degree as to demand immediate and compulsory action.

Denying Highway Service

SIGNS have been apparent to the observing for some time that conflict would soon arise over the division of road use by heavy business vehicles and the private automobile. Two state highway administrations have arrived at the decision to act in the matter. The Commissioner of Motor Vehicles of Pennsylvania and the Public Utilities Commission of Ohio have issued orders drastically curtailing the privileges of motor-truck transportation businesses in the use of the public roads.

In Pennsylvania the restriction is the quite conservative one that motor-truck trains—coupled trucks and trailers—shall not exceed 80 ft. in length. The Ohio action is of wider scope; it contemplates denying permits to truck transportation lines where roads have reached the point of "maximum use." Such prohibition of service raises questions vital to all road interests.

"It is not intended," states the Pennsylvania commissioner, "to allow the people of this state to be pushed off the highways they have built with their own money." This fairly expresses the spirit that is growing out of unregulated trucking practices, though the statement quoted sounds as though the excessively long motor-truck trains had been coming from other states. In any event a legal restriction to 80-ft. length is not an unreasonable limitation; drivers who have to cut around a long convoy on a busy road will certainly not think it too little. On the whole the Pennsylvania edict does not cause much present concern. That of the Ohio utilities commission is more serious.

Nominally the Ohio action is based "entirely upon danger to the traveling public and injury to the highways." Actually the reason is the question of "convenience and necessity" for interstate truck line transportation. The commission indicates its attitude when it says that it is time that the losses suffered from truck haulage by railways be recognized, and expresses its feeling that long-haul heavy-freight traffic "should not be further diverted from the rails."

Obviously the state has an economic right to regulate traffic on its public roads so that safety and the road struc-

ture are not endangered by loading, speed or size of vehicle units. Also, it has the right to apportion kinds of traffic so that service to the majority of users shall not be excessively curtailed by special service sought by a minority. These rights, however, are applied unjustly when they are exercised solely for prohibition. The broader interpretation is that they involve an obligation to extend road service to include a wider range of transportation demand. The highway is built to provide transportation service; it offers no other justification for the vast sums of tax money being spent in its improvement. This contemplates neither curtailment of existing uses nor prohibition of new uses, but at best only reasonable regulation.

The situation as it has arisen between automobilists and commercial bus and truck lines leads to the conclusion that separate service is inevitable. Physically the means may be the addition of lanes for heavy vehicle traffic to the present roadway or the construction of separate roads for trucks and buses. These agencies, and particularly the out-of-state truck line furnishing interstate transportation, are presenting a difficult and increasingly pressing problem to state highway administrations. But the solution of this problem does not lie in denying the function of the public road to serve transportation of any class which demonstrates economic justification for such service.

Bidding for Professional Services

NO LITTLE interest has been aroused in Denver by a controversy over architectural work in the new city hall. It is largely a political storm centering around the practice of architecture rather than engineering, but it has resulted in a court decision concerning the practice of architecture and the engagement of architectural services by the city which is equally applicable to engineering services. In this the controversy is of interest to engineers.

Nearly seven years ago the city of Denver undertook to build a new city hall. It was to be a monumental structure costing several million dollars, whose design and construction would be a rich plum for the architect who landed it. Rumor states that the then mayor intended to hand the job to one of his personal friends who was not too popular with the rest of the profession. Be that as it may, for some reason not now evident, possibly with the idea of spreading such a big job among several offices, the principal architects of the city, about 40 in number, organized the Allied Architects' Association and were successful in getting the mayor to engage the association to design and supervise the construction of the city hall.

Work was soon undertaken, but the whole operation dragged as most operations do when politics is deeply involved; the task is still uncompleted. Much of the delay centered around an attempt of the architects to use stone from outside the state, although the law requires that local material be used when it is adequate to meet the specifications. Those who favored the use of local stone actively opposed the Allied Architects' Association on the ground that its contract with the city was illegal.

Late in July of this year the state supreme court declared the contract illegal, reversing a decision of the local district court. The majority opinion stated: "The vice of the contract is that instead of the city naming the architects who shall design and construct the building it has agreed that the association shall name them. It seems to us too plain for argument that the city has signally failed to exercise wise and unhampered judgment in seeking such services where the qualities of reputation and professional trustworthiness may disappear, and not through the failure in that regard of any of the gentlemen with whom the city originally contracted, but through the absence of such qualities in those of whom the association may at a given time be composed." The court's finding of illegality was based first upon the ground that the association was not licensed to practice architecture and was incapable of obtaining such a license and so was incompetent to contract to render architectural services; and second on the ground that the contract had not been let subject to general competition as required by the city charter. One judge, in a dissenting opinion, held that the city charter does not require calling for bids for professional services and that it is not the association but its members who practice architecture.

As a result of the court's findings the city has taken over the work. Roland L. Linder, formerly chief draftsman for the association and a member of the American Institute of Architects, has been appointed supervising architect and suit has been instituted to collect $197,000 paid to the association for its services up to the time the contract was declared invalid.

Obviously, what the court said with regard to architectural services is equally applicable to the practice of engineering. Both professions have stood out against professional practice by corporations as such. The same is true of the legal and medical professions. The court put its finger on the argument against such practice when it said that it is not the lack of professional qualities in the men composing the corporation when the contract is made but the possibility of such qualifications being lacking in those of whom it may be composed at some future date that makes it impossible to determine in advance the quality of the professional services to be rendered throughout the life of the contract.

As to the court's second finding, that bids should have been called for professional services, little support so far is found for it in either profession. True, there have arisen instances in recent years where the complexity of our modern civilization seemed to indicate that the only way for some communities to get adequate professional advice is through a call for bids, but such could not be the case with architectural services in Denver. An ample number of men of known professional record and ability is available; the American Institute of Architects alone has 25 members resident there.

The outcome of the whole controversy is in doubt. While the court's ruling stands, engineering and architectural services on public works in Colorado must be obtained by competitive bids. Codes of ethics may have to be modified accordingly. The more serious implication in the whole matter is that what the Colorado supreme court has done may set a precedent for courts elsewhere. Non-competitive award of professional engagements always has been in disfavor with those outside the profession who cannot see the fine distinction between professional and non-professional services. With the Colorado decision as a start they may be expected to renew their attacks. Is the profession ready for such a fight? Does it know its own mind in the matter of competition for professional work? If competitive bidding is to come, is the profession ready to shape public thinking along constructive lines? These questions are brought prominently to attention by the Colorado supreme court decision.

Panel System of Tile Drainage for Selfridge Flying Field

Important army airport on boggy ground bordering Lake St. Clair and Clinton River converted to all-year, all-surface flying field by 63 miles of subsurface drains

By CAPT. ROBERT S. BEARD
Office of Quartermaster General, Washington, D. C.

A SUBSURFACE drainage system completed in 1930 has eliminated the annual toll of eight to ten major airplane accidents caused by the prior soft condition of Selfridge Field. This field is located on the shore of Lake St. Clair in Michigan, about 20 miles north of Detroit. The 641-acre reservation lies between the lake on the north and Clinton River on the south, and about 70 per cent of the area is below record high water. A levee and an interior drainage ditch protect it from overflow and take the natural runoff to a pumping station on the lake front. The general slope of the ground is about 1 in 1,000 toward the lake.

Most of the ground is a glacial sand-clay, with an underlying bed of water-deposited clay, practically impervious, at an average depth of 5 ft. The clay rises to the surface at the northwest corner of the field; in the southern part are considerable areas of sand, 90 per cent of which passes a 50-mesh and 29 per cent a

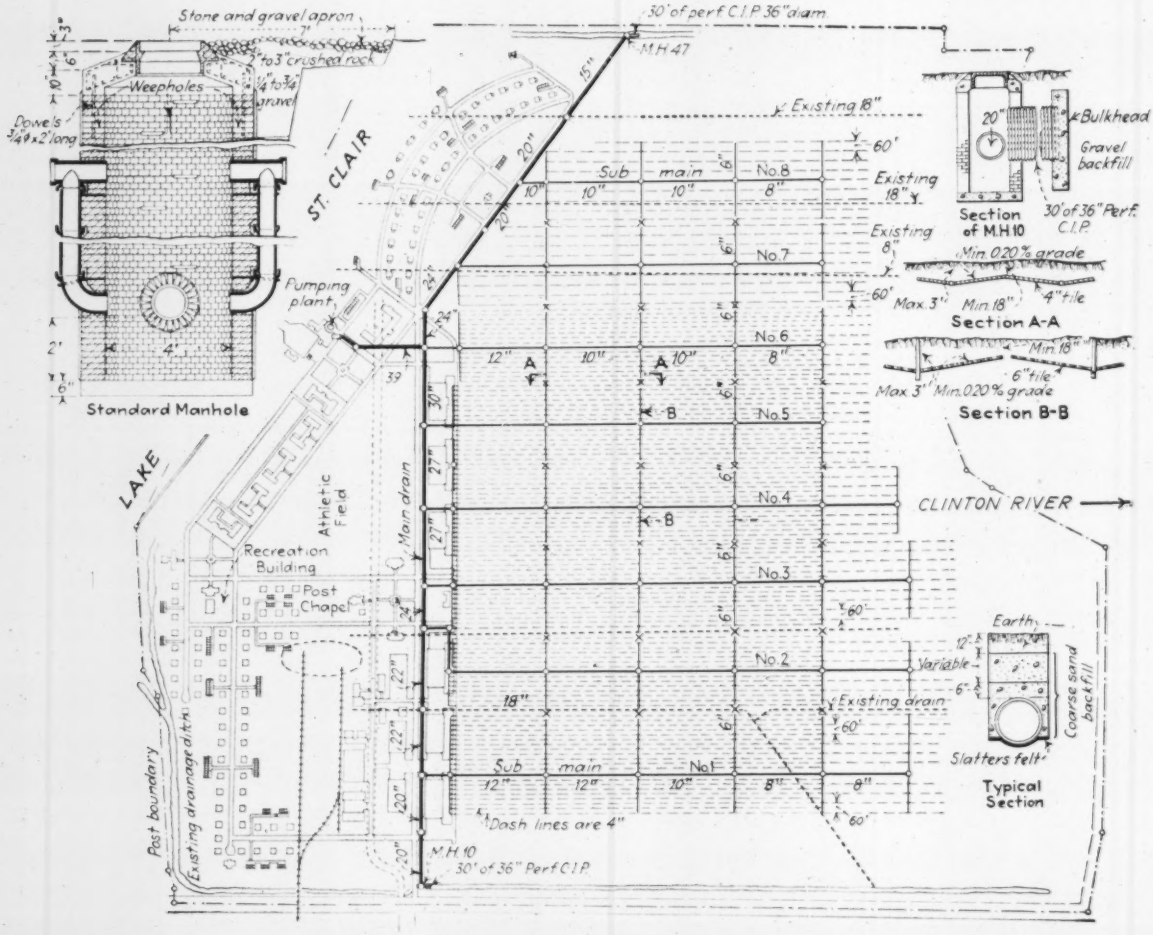


Fig. 1—Plan and details of tile drainage for Selfridge Flying Field, Michigan

100-mesh sieve. Soil, topography and water conditions, in brief, made a field so soft that for three months of the year airplane landing and taking off were hazardous. In 1930, following drainage, almost the entire flying field of 425 acres was safe. The drainage system that accomplished this improvement cost $150,230 and consisted of a pipe and tile grid, as shown by Fig. 1.

Experiment With Mole Drains

Before deciding on tile drains a careful investigation was made of mole drainage, which appeared to offer a reduction in cost and less disturbance of the surface.

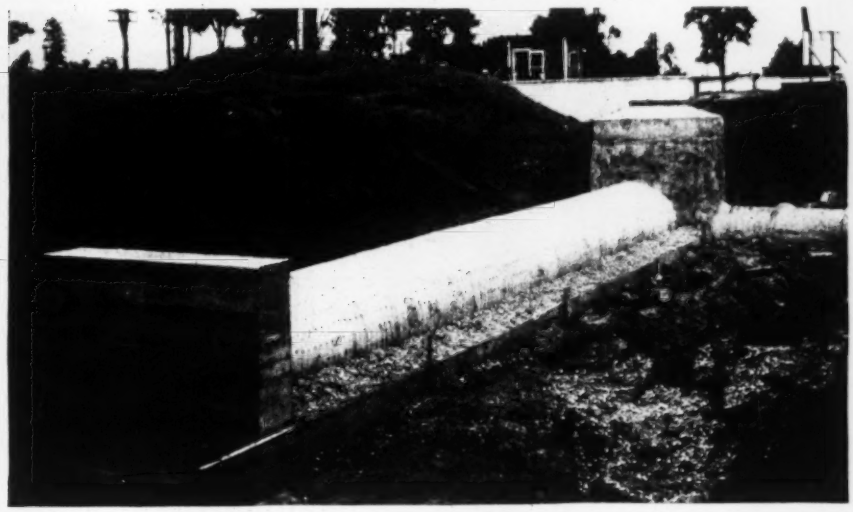


Fig. 2—Perforated-pipe ditch inlet for main drain

Five or six miles of 4- and 8-in. mole drains were installed. They functioned satisfactorily at first, but because of the amount of fine sand in the soil nearly all trace of them disappeared within a year.

Permission was obtained to experiment with a pneumatic jack especially constructed for jacking 4-in. tile into mole-drain holes. This method failed because the mole holes were somewhat oversized and occasionally permitted a tile to roll out of line on the return stroke of the jack. When this happened the tile was crushed in the next thrust stroke. However, lengths of tile up to 250 ft. were successfully jacked into position and it is believed from the experience gained that the method can be made practicable if concrete tile is used and a heavy mole plow is developed along the lines of a trench excavator, with power-operated grade controls.

Tile Drainage System

As shown by Fig. 1, the tile system consists of panels formed by submains and cross-drains intersecting at right angles, with a manhole at each intersection. The submains empty into a trunk drain, or collector, leading to the pumping plant on the lake shore. The cross-drains slope both ways from the sides of the panels to the submains, and the tile drains that parallel the submains slope both ways from the panel centers to the cross-drains. The sections in Fig. 1 show this peak and valley arrangement, as well as the drain sizes. The system was designed for a runoff of $\frac{1}{2}$ in. per hour for 24 hours. Since unusual care was taken in drain grade and line, Kutter's $n = 0.013$ was used to determine drain sizes.

The main drain is concrete pipe of the diameters shown by Fig. 1, and it was laid on a grade of 0.013 per cent determined by the flow line of the drainage ditches and the floor of the pump sump. The only special structures are the inlets at the ditch ends, shown by Figs. 1 and 2. These long perforated inlets have been particularly free from clogging.

Farm tile was used for the submains, which have grades of 0.15 per cent. The depth was controlled by the depth of the tile grid at the upstream ends. They were kept as shallow as possible so that the trenches could be dug with the smaller sizes of wheel trench excavators. Each submain enters the main drain at a manhole; drop lines at manholes take up the differences between invert elevations. Similarly the 6-in. farm-tile cross-drains enter the submains at manholes that are dropped where the difference in invert elevations exceeded 18 in. The collecting drains connect with the cross-drains by double Y's and eighth bends. Grades and depths of cross-drains and collecting drains are shown by the sections of Fig. 1.

All farm-tile lines were laid on roofing felt and were backfilled, as shown by the typical section on Fig. 1. The tile joints were made as tight as practicable, and when open as much as $\frac{1}{4}$ in. they were covered with strips of felt or tile bats. All dead ends were plugged or capped. Coarse sand, $\frac{1}{4}$ in. to 5-mesh, was used for backfill except for the top 12 in., which was topsoil and turf. The trench widths were 12 in. for 4- and 6-in. tile; 15 in. for 8- and 10-in. tile, and 20 in. for 12-in. tile.

A special type of manhole (Fig. 1) with a deep grating cover was designed. The apron was dished and drained through four weepholes in the walls.

Design Considerations

The panel grid described was adopted because it appeared to afford economic and functional advantages over the more conventional herringbone and rectangular grids. Briefly, the considerations were:

1. The panel grid, which breaks grade every 200 or 300 ft. and is connected to the submains through drop manholes, can be kept more uniformly close to the surface and at the same time provide long continuous runs for trench excavators.

2. The herringbone grid provides equally short runs to the submains, but as the submains go deeper toward their outlets so must the collector lines. The large number of short lines requires the frequent pulling up, backtracking, lining up and digging in of the trench excavators.

3. The long runs (700 to 2,000 ft.) of the small tile of rectangular grids require flatter grades and must go deeper than efficient drainage permits to secure sufficient cover at low spots.

4. The panel grid, with its steeper grades and smaller watersheds, provides, with tile of equal size, larger runoff capacity than the rectangular grid; it is better to have the short steep grades on the collectors and the long flat grades on the carriers.

Fig. 3—Trench excavators digging tile ditches and loading spoil direct to trucks

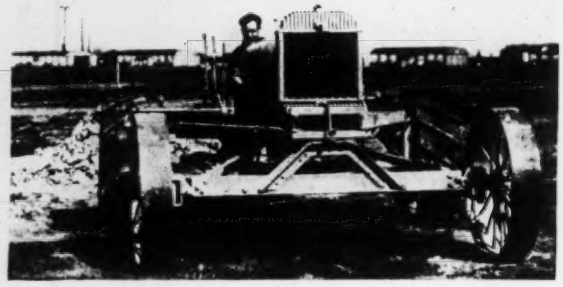


Fig. 4—Backfilling trenches with grading machine

5. The panel grid has the fewest dead ends; the frequent manholes give better ventilation to the soil; all water enters the carriers through silt traps; and when a collector is plugged, a smaller footage is out of service, and the manholes facilitate the location of the trouble.

6. The panel grid rapidly dewaters the surface soil for airplane operation, provides ample depth for turf-root growth and keeps the water table high enough to provide capillary moisture for growth.

Cutting the tile spacing in half cuts both the length of the watershed and the total flow in half without changing the size of the soil-flow channels, so that the rapidity of the removal of the surface water will be more than doubled. Close spacing flattens the arching of the water table between the tile lines and makes it practicable to place the tile closer to the surface and still maintain the desirable 12- to 24-in. depth of drained root bed and landing crust. This reduces the average depth of the water table between rains when moisture is supplied by capillarity. Therefore, shallow tile closely spaced is the most satisfactory for the maintenance of a firm turf for a flying field. For this reason a 30-ft. tile spacing with a minimum cover of 18 in. was used in the section of the field where the traffic is heaviest, so far as the available funds permitted.

Water flows down to the water table as nearly vertically as the irregular flow passages in the soil will permit, and then flows into the tile from the saturated area, mainly through the lower section of the tile joint. It is therefore more important to seal the underside of the tile against sand and silt than the top side, and it was for this reason that the bottom of the trenches were lined with 30-lb. roofing felt. The coarse-sand backfill was adopted as a result of tests that show the entrance of very little sand through the joints and indicate that the top soil was carried to a far less depth into the sand than into gravel backfill.

After a year's operation and experience with a heavy thaw the following changes in design are suggested:

1. Design for a runoff of $\frac{3}{4}$ in. per acre per 24 hours instead of $\frac{1}{2}$ in. This would not affect the sizes of the 4- and 6-in. lines, and the resulting increase in the larger lines would add only 5 to 8 per cent to the entire cost.

2. Omit the stone aprons at the manholes. These aprons mashed up somewhat under the airplanes. It would be better to make the entire backfill around the manhole of sandy gravel to 12 in. from the surface and cover with topsoil and turf.

Construction Methods

Construction was begun July 3, 1929. The contractor was required to stake out the lines and run all grades from benchmarks established by a topographical survey. This required two field parties much of the time. The constructing quartermaster utilized a superintendent of construction, four inspection engineers, a rodman and a chainman to direct the work, check grades and make quantity surveys and estimates. The contractors for trenching and tile-laying were W. J. Campbell, Armada, Mich., and Kagay & Mann, Richwood, Ohio.

The main drain and the deeper parts of the submain were laid by ordinary sewer-construction methods. The rest, comprising the shallower submains, the cross-drains and the farm-tile grids, were constructed two submain units at a time, and the work was finished completely as it progressed. When half of the field was finished, flying operations were transferred from the untiled to the tiled area without loss of flying time.

A sod cutter pulled by a small tractor first stripped the sod off the trenches. Then wheel-trench excavators (Fig. 3) opened the trenches, working to grade targets set every 50 ft. and at the breaks in grades. The trench excavators could cut to within $\frac{1}{4}$ to $\frac{1}{2}$ in. of grade, and from 3,000 to 3,500 ft. of tile per machine per eight-hour day could be laid. The maximum day's work for one machine was 4,025 ft. cut to an average depth of 2 ft. in sandy soil; that day also three machines completed 11,000 ft.

To preserve the sod the material excavated from the trenches was loaded by machine into trucks and hauled to make fills on various parts of the development. The belt conveyors on the trench excavators were lengthened to load into trucks by counterbracing on the opposite side. The trucks took away excavated material and hauled backfill gravel as return loads.

The tiles were distributed along the trenches in piles of a dozen; fewer tiles were thus broken than when they were strung along the trenches. The roofing paper on

which the tile was laid was cut from rolls by an oil-lubricated crosscut saw operated by the rig shown in Fig. 5. The strips were creased into V's and laid with 4-in. laps. Backfilling closely followed the tile-laying. This was coarse sand to within 1 ft. of the top of the trench (Fig. 1) and soil and turf on top. The sand was brought in by railway cars, which were unloaded by a belt conveyor into a 100-yd. elevated hopper under which the trucks were driven to take their loads. The backfill was dumped from the trucks directly into the trenches and leveled by hand. About 6 per cent of the gravel was lost by direct dumping. The top fill of earth was bladed and rolled flush with the surface.

The work was handled economically with excellent equipment and a large organization aided by excellent weather conditions (only one day was lost because of rain). At the peak of the tile-laying operations 40 trucks, 4 trench excavators and 125 men were employed. The hourly wages were: common labor 60 to 75c.; truck and driver $1.50; bricklayers $1.50; and gang foremen $1.25.

The subcontractors for trench and tile laying received 4c. a linear foot. There were three laborers and one operator for each machine. The general contractor, R. D. Baker, Detroit, Mich., staked lines and grades, cut the turf, delivered the tile, felt and backfill, hauled the excavated material and did the backfilling. The contract prices for drain tile in place ranged from 25c. a linear foot for 4-in. to 77c. for 12-in. tile.

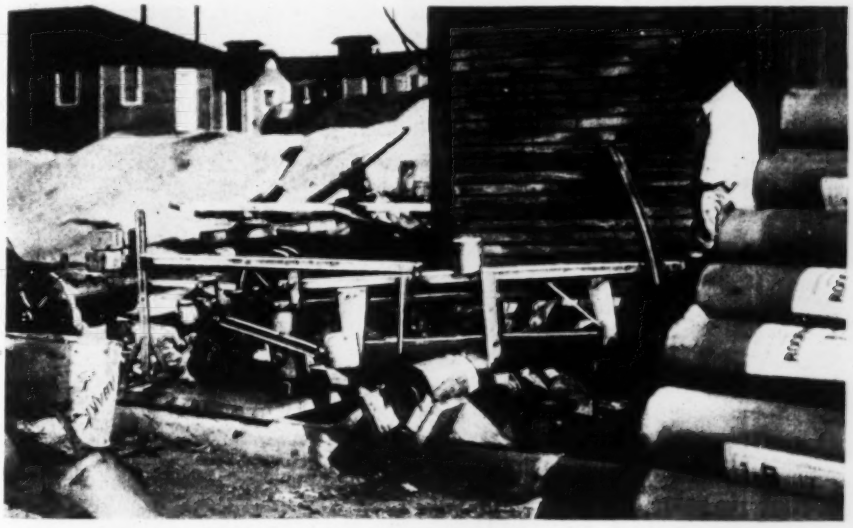


Fig. 5—Sawing rolls of roofing felt into lining strips for ditches

Pumping Plant Reconstruction

Reconstruction of the old drainage pumping plant was included in the undertaking. The old plant was built largely of wood and contained four centrifugal pumps with a total rated capacity of 10,800 g.p.m. The new plant is a structure of concrete and brick with three low-lift axial-flow pumps, having a total capacity of 19,300 g.p.m. Two of these pumps have a rated capacity of 8,000 g.p.m., which is sufficient to handle a runoff of ½ in. per acre per day from the entire watershed. The third pump, of 3,300-g.p.m. capacity, can handle a runoff of 0.2 in. per acre per day. This smaller pump does fully 90 per cenet of all the pumping because it handles all of the dry-weather flow.

Engineers accustomed to designing storm sewers for municipalities where there are large areas of impervious surfaces and where smooth pipes and channels laid on good grades carry water directly to the sewer inlets may question whether the pumps were designed for a sufficiently large runoff. Unit concentration periods for the tile drains will range from six to twelve hours, as compared to 15 min. or less in well-developed municipal areas. Also, a smaller percentage of water reaches the drain. Our experience over a period of twelve years of pumping the runoff of this turfed area has demonstrated that the small pump and one of the large pumps, with a total capacity equivalent to the rate of 0.7 in. per acre per day, can handle the normal maximum runoff of the field. It has been found that the heaviest runoff results from winter and spring thaws.

Screw or axial-flow pumps were selected in preference to centrifugal pumps on account of their lower first cost and more economical operation; also because a more compact layout was possible with the existing pump pit. The normal type of constant-speed centrifugal pump operates at good efficiency only through a very narrow range of head, whereas the axial-flow type of pump can operate efficiently over a considerable range of head. This fact favored the selection of the latter type of pumps for the work.

The pumps are operated by float-controlled switches set at different levels, so that each pump is brought into service automatically as required and is shut off as the discharge from the field decreases.

The new 3,300-g.p.m. pumps consume 0.041 kw.-hr. per 1,000 gal. pumped against its average 7.5 ft. static lift, as compared with 0.087 kw.-hr. per 1,000 gal. with the old pump; and the two new 8,000-gal. pumps consume 0.038 kw. against their average static lift of 5.5 ft., as compared with 0.80 kw. for the old pump. The pumps and control equipment were supplied by the Worthington Pump and Machinery Corp.

The value of tile drainage was demonstrated by the last soft field accident, which occurred on April 6, 1930. A plane coming in over the lake with the whole field ahead of it, landed on the untiled area in the northeast corner, on which 46 sets of officers' quarters have since been constructed. A 10-ton tractor was sent out to pull in the overturned plane after the field ambulance and a six-wheel Coleman truck equipped with 42x9-in. pneumatic tires had become mired on the way to the scene. The track of the tractor treads, where they passed over the tiled area, varied from about ½ to 1½ in. in depth. They became from 4 to 5 in. deep shortly after they left the tile. The tractor finally buried itself in front of the plane, which was about 150 ft. distant, and it was necessary to use railroad ties to form a track for it.

Selfrige Field is now an all-year-safe, all-surface flying field. The east third of the tiled area was never used formerly because of its dangerous swampy condition.

Noise Reduction

Its Problems and Prospects

By F. R. WATSON
Professor of Experimental Physics, University of Illinois, Urbana, Ill.

City noise as a practical and economic evil—Its measurement and abatement as problems for the engineer and scientist

THE PROBLEM of noise nuisance is receiving increasing attention and is a field for the engineer, both as to measurement of noise and methods of reducing it. Every city experiences its disturbance in the clanging street car, the honking auto and the gear-grinding truck, while elevated railroads, riveting machines and factory apparatus may add to the din. This pandemonium of noise tends to produce impairment of hearing, it induces a strain on the nervous system, causes loss of efficiency for workers and thinkers and interferes seriously with sleep. As a result, determined efforts are being made in large cities to reduce all noise, with the first attack being made on unnecessary noise.

To make this compaign effective it is first necessary to secure convincing evidence of the harm done by noise, for which purpose instruments and methods have been developed and scientific data collected. In New York City a noise-abatement commission, consisting of business men, doctors, lawyers and scientists, conducted a systematic study of the problem, with results given in reports published in 1930 by the city's department of health. Not only did the commission show the extent of the evil but it secured the adoption of quiet turnstiles in the subway and the passage of a law prohibiting the unnecessary use of automobile horns.

Noise is an unpleasant sound (usually loud) of short duration, lacking in musical characteristics. Even music may be undesirable if it is too loud, or if it interferes with a person's activities or rest.

Measurement of Noise—Loudness of noise is expressed in terms of the "decibel," a unit that has been developed recently to represent the action of hearing. Two average sounds differ approximately by one decibel when a person is just able to distinguish that one sound is louder than the other. While 100 violins are ten times as intense as ten violins, the loudness, as perceived by the ear, is only twice as much. The intensity is a measure of energy, and it may be expressed in horsepower or watts; but the hearing sensation is measured in units that are proportional to the logarithm of the intensity. The ear acts in a peculiar manner; it is extremely sensitive for faint sounds, but it becomes more sluggish and insensitive as the sound gets louder. The energy of sound is very small, that of the conversational voice being only about 10 microwatts. The corresponding values of the intensities and loudnesses of the usual range of sounds are given in Table I, and the accompanying diagram lists common noises in terms of decibels. In explanation of the units in Table I, a threshold sound is one that can be just preceived by a normal person. This is taken as the unit for sounds that are listened to. On this basis it has been found experimentally that an average sound is about a millon times as intense, or 1,000,000 threshold units. In terms of loudness, the units of intensity become units of loudness experssed in decibels, as show in the table.

Harmfulness of Noise—A noise becomes harmful when it affects physical well-being. Clerks in a noisy bank room make more mistakes than a similar group in a quiet room; employees in a noisy factory are likely to be less efficient in production than those under quiet conditions. Office employees become more nervous when in rooms with noisy machines and typewriters. Accord-

TABLE I—COMPARATIVE VALUES OF SOUNDS

Intensity (I)		Loudness in Decibels $10 \times \log I$	
1	(threshold sound)	$10 \times \log 1$	= 0
10	(threshold units)	$10 \times \log 10$	= 10
100	do.	$10 \times \log 100$	= 20
1,000	do.	$10 \times \log 1{,}000$	= 30
1,000,000	do.	$10 \times \log 1{,}000{,}000$	= 60
1,000,000,000	do.	$10 \times \log 1{,}000{,}000{,}000$	= 90

TABLE II—NOISE IN SUBWAYS

	Intensity	Total Intensity (I)	Loudness in Decibels $10 \times \log I$
Wheels	1,000,000,000	1,000,000,000	90.0
Rails	1,000,000,000	2,000,000,000	93.0
Motors	1,000,000,000	3,000,000,000	94.7

ing to a paper on "Measurement of Noise," by G. W. C. Kaye (Royal Institution of Great Britain, May 8, 1931): "It is only when the noise is stopped that the pronounced sense of relief makes one realize that one has been unconsciously bracing oneself against the noise." It is difficult to secure numerical estimation of this damage, but certain recommendations have already been formulated for the correction of the nuisance. ("The Effects of Noise," by D. A. Laird, *Journal* of the Acoustical Society of America, Vol. 1, 1930, p. 256.)

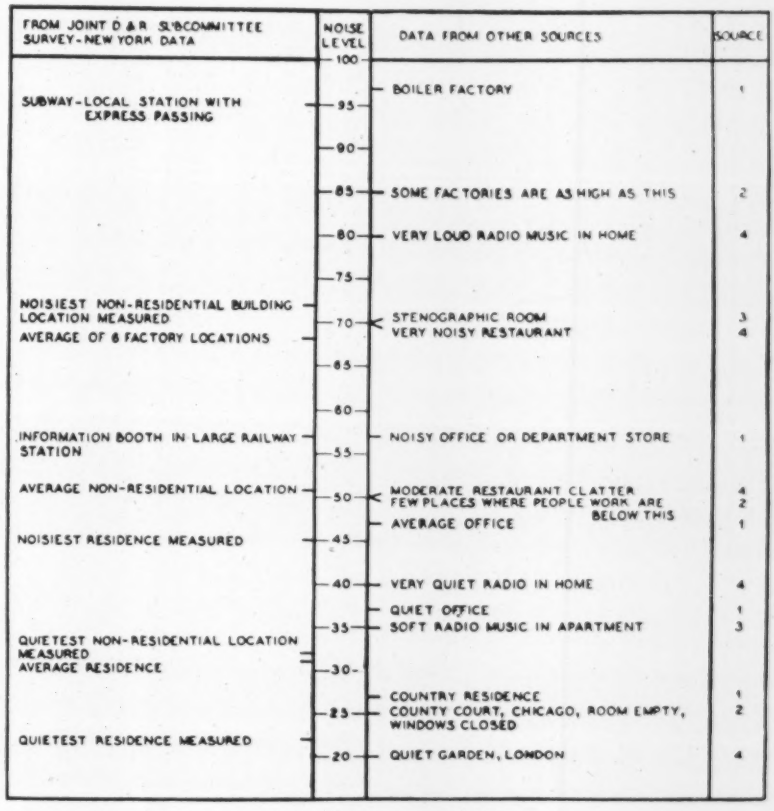
Not only is noise injurious when continued for some time, but some types of noises are sources of immediate danger. A sudden or unexpected or unusual loud sound produces a sensation of fear and confusion. Crossing a noisy street with an elevated train passing overhead is a nervous proceeding for many people and introduces possibilities for accidents.

Reduction of Noise—Office quieting with sound-absorbing materials is now an everyday matter. Hotel keepers find that quiet rooms with effective soundproof partitions are preferred. It is common practice for a small factory or printing concern to rent an entire floor in a building, in which case it becomes necessary to mount machinery so as to prevent the transmission of sound and vibration to other floors.

The practical question arises as to the value of the results obtained. Any noise higher than 50 decibels may be considered objectionable. Effective partitions between rooms will reduce sound from 25 to 45 decibels; anything less than 25 decibels is not worth much, while a greater reduction than 45 decibels is unusual. In office quieting the reduction by sound-absorbing material is less

than for partitions, being only from 5 to 10 decibels. But actually the reduction appears greater than the number indicates. For example, if a loud sound is reduced 5 decibels, it appears approximately 75 per cent as loud as before, while for 10 decibels reduction the sound is judged as only half as loud. Furthermore, the time reverberation is reduced, which produces other benefits not here considered.

The most effective method of reducing noise is to make the source quiet. The automobile is a suggestive example. Nobody wants a noisy car; it is unlawful to operate a car without a muffler, and in New York City the unnecessary honking of horns is prohibited in the theater districts. Public opinion is extending its influence to reduce other noises. It is of interest to note also that substantial progress in the quieting of electric cars has been made on the Detroit street railways by the development of a worm-gear drive. Such a car is said to be quieter, more easy-riding and more efficiently operated; some 60 per cent of the noise is eliminated, and there is a material reduction in the weight of the car. One promising feature about noise reduction is its economic advantage, for a quiet machine has longer life and less upkeep expense.



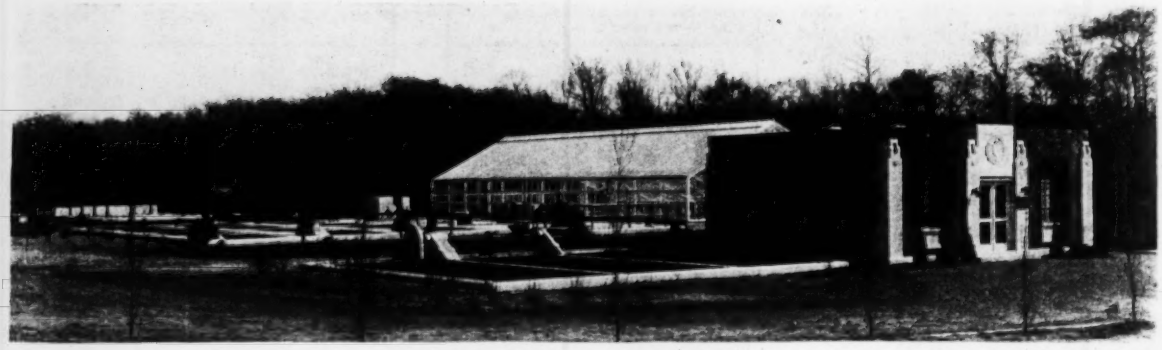
Scale of noise in buildings

Sources of records in right-hand column: (1) "Speech and Hearing," by H. Fletcher, p. 187; (2) article by D. A. Laird, *Scientific American*, December, 1928, p. 509; (3) article by W. Waterfall, *Engineering News-Record*, Jan. 19, 1927, p. 60; (4) article by A. H. Davis, *Nature*, Jan. 11, 1930, p. 48.

Subway Noises—When adjusting a machine to make it quiet it is found necessary to reduce all the elements of disturbance to about the same value. It is a waste of time and expense to reduce only one element of noise. Subway noise is generated almost entirely by the impact and friction between wheels and rails, resulting in further noise by vibrations of both wheels and rails, as well as the car and the ground. An additional disturbance comes from the driving gears. When studying this problem the writer set up two large steel channels to imitate rails, one of which was padded with hair felt and the other left bare. Striking the padded rail with a hammer gave a sound about 20 decibels less than the sound emitted by the bare rail when struck in the same manner. But when padded rails were used, with cars running on them, the reduction could not be noticed. The explanation is given in Table II, from an article on "Noise in Subways," by the author (*Journal* of the Acoustical Society of America, July, 1931). Assuming 1,000,000,000 threshold units of noise for each of the three elements (wheels, rails and motors) the following values given were obtained. All three noises operating together gives 94.7 decibels. Eliminating one noise completely still leaves 93 decibels, a reduction that would not be detected by a normal ear, so that no quieting would be observed. (In machines where one element of noise is evidently greater than the others a noticeable reduction would follow if this single noise was reduced.) If all three loud noises are reduced to the value of 1,000,000 each, an acceptable change would follow, the total loudness for all three noises being only 64.7 decibels, or a reduction of 30 decibels. The physical relief due to reducing the loudness from 94.7 to 64.7 decibels is somewhat as if the temperature on a hot day should be reduced from 94.7 to 64.7 deg.

Masking of Noises—The effect of one sound masking another sound is an important element in noise reduction. For example, the conversation in a doctor's office could be heard plainly in the waiting room in spite of a soundproof partition and double doors. It was found that as the office fronted on a noisy street the conversation was carried on at about the same sound value as the street noises (70 to 80 decibels), while the waiting room opened upon a quiet hallway (30 decibels or less). Thus the conversation was masked by the strong street noise but not by the weaker hallway noise. The remedy was to install a second partition or to use a double window or window muffler in the office.

Conclusion—It is evident that noise is harmful to people, and in some cases it is dangerous. It is possible to reduce noise, but progress appears dependent on public opinion. Of various agencies engaged in combating noise the noise-abatement commission in New York City is perhaps the most aggressive. The Acoustical Society of America has an investigation committee and expects to formulate standard measurements of noise. The American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the National Electric Manufacturers Association have held a symposium on noise reduction in Rochester, N. Y. (*Electrical Engineering*, May, 1931, pp. 340-354). Similar movements are in progress in foreign countries. It seems certain that the next few years will witness a marked improvement in the reduction of city noise.



View of sewage-treatment plant at Barrington, N. J.

High-Degree Sewage-Treatment Plant at Barrington, N. J.

Pre-sedimentation, activation, post-sedimentation filtration, chlorination and sludge digestion—Covered sludge beds

By W. D. VOSBURY and P. B. STREANDER
Remington, Vosbury & Goff Consulting Engineers, Camden, N. J.

SEMI-RAPID sand filtration and chlorination complete the treatment given by the newly completed activated-sludge plant of Barrington, N. J. Before activation the sewage passes through a grit-and-screen chamber and a presettling tank. The excess sludge goes through heated digestion tanks and to glass-covered drying beds. Incoming sewage is measured. Activation is effected by paddle wheels instead of by compressed air. The rapid sand filters are provided with rate-control and loss-of-head rate-of-flow gages.

A high degree of treatment is required, because the only stream available for receiving the effluent is a small brook that follows a winding course through a populous district before entering tidewater 2 miles away. The sewage from a contributing population of 6,000 is treated by the activated-sludge process before it is filtered. Aeration is accomplished by mechanical agitation of a type that causes a spiral flow through the tanks. The return sludge is added to the presettled sewage after aeration has proceeded for a period of time that is under control of the operator. A continuous flow of sludge is maintained through the covered digestion tanks, where digestion is aided by heating coils, combustion of the collected gas furnishing the necessary heat. Sludge-drying beds are glass-covered. After the finally settled sewage has passed through semi-rapid sand filters similar to those used in water purification it goes to a chlorination providing a 30-min. contact period before it is discharged into the brook.

An outfall sewer to tidewater was not practicable. Difficulties in obtaining the necessary rights-of-way were encountered, and it was opposed by the towns through which it would pass. It therefore became necessary to design a plant to meet the natural conditions imposed by an extremely low dilution factor and the probability that during very dry weather the effluent would not reach tidewater for several days. Only an effluent that would be fully stable, that would absorb little or no oxygen from the brook and that would contain practically no bacteria could qualify for these conditions. In other words, the requirements were comparable to those for drinking water. The plant was designed to produce a clear effluent having a five-day biochemical oxygen demand not greater than 18 parts per million, and a twenty-day period of stability. A further stipulation was that no bacteria were to be present in 5 c.c., with a residual chlorine content of 0.5 p.p.m. at the end of a 10-min. contact period.

The capacity of the plant is 600,000 gal. per day, based on a connected population of 6,000 contributing a maximum average daily flow, including infiltration of 100 gal. per capita. The units used in designing the various parts of the plant were:

Preliminary clarification tank, detention period, hours	1
Aeration tank, detention period, hours	6
Aeration tank, return sludge, per cent	25
Final settling tank, detention period, hours	1½
Rapid sand filters, gal. per sq.ft. per min.	1½*
Contact tank, detention period, minutes	30
Sludge digestion tank, volume, cu.ft. per capita	2
Sludge-drying beds, area, sq.ft. per capita	½

*About 94,000,000 gal. per acre per 24 hours.

When the sewage enters the plant it passes through a combined screening and detritus chamber and then over two V-notch weirs working in parallel. A motor-operated depth gage transmits the head on the weirs to the recording apparatus in the control room of the filter building.

Preliminary Clarification Tanks

The two presettling tanks are each 8x32 ft. in plan, with a settling depth of about 7 ft. There are four hopper bottoms to each tank, 8 ft. square by 3 ft. deep. The solids are removed from the hoppers through sludge pipes under a hydrostatic head of 4 ft.

The presettled sewage passes to a diversion chamber from which equal volumes of sewage are discharged over adjustable V-notch weirs into compartments, from which it is piped to the three aeration or activation tanks.

Aeration Tanks

Aeration is effected mechanically by paddle wheels set at one side of each tank, with the lower part submerged about 6 in. The rotation of the paddles causes the sewage

Paddle aerators impart a spiral flow to the sewage

Baffles at the sides and bottom of the aeration assist the aerator in causing a complete turnover of the flowing sewage. The return sludge is introduced after aeration has proceeded for a time on the sewage alone.

to flow across the tank to the opposite wall, where it is deflected downward by an inclined baffle, set at an angle of about 45 deg. At the bottom it is again deflected by a second baffle to the other side of the tank, where it rises between the tank wall and a vertical baffle wall constructed under the paddles. The vertical baffle is 18 in. from the face of the wall.

The tank is divided into three separate compartments, each 12½x60 ft., with a sewage depth of 12 ft. The total depth of the tank is 14½ ft., the extra 2½ ft. being required to provide clearance for the agitator. The effluent from the presettling tank is piped to the upward-flow channel behind the vertical baffle. Returned activated sludge is applied to the sewage through piping so arranged that the point of application can be changed to provide a variable pre-aeration period. The object of the pre-aeration is to freshen the sewage by driving off toxic gases it may contain, which are deleterious to the delicate organisms in the return sludge. Pre-aeration of the sewage prior to the application of the sludge also reduced the time required for complete activation.

The aerating mechanism is connected to an electric motor through a speed reducer, with the sprockets and chain placed at one end of each compartment. The tops of the deflector baffles are covered with wood, forming walkways to give access to all parts of the tank. The aerator imparts a transverse direction to the sewage, resulting in a spiral motion through the tank each turnover exposing the full contents to the atmosphere.

Final Settling Tank

After aeration the mixture of sewage and activated sludge spills over a baffled rectangular weir into flumes at the ends of the compartments, from which it is piped to the final settling tank. This tank is divided into three compartments, each 12..36 ft., with an average sewage depth of 6 ft. Sludge is continuously removed by mechanically operated sludge scrapers, which push the sludge into hoppers at the influent end of each compartment. These hoppers are provided with perforated water piping arranged to flush down any solids adhering to the sides.

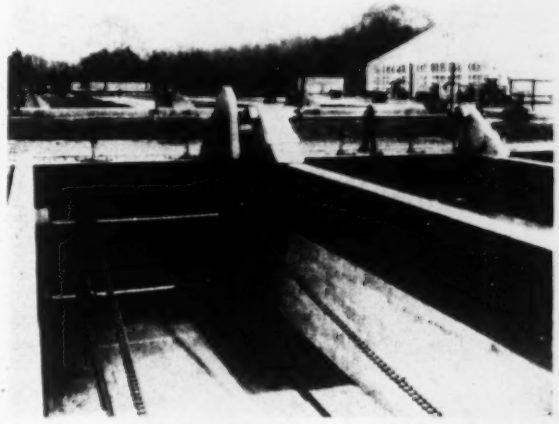
Sludge is removed from each of the hoppers by means of a vertical sludge pipe, emptying into a sludge-withdrawal chamber. The bottom of this chamber is 15 in. below the sewage level. An adjustable sludge decanter is provided, consisting of a short length of 6-in. brass pipe cut with a V-notch weir, and sliding inside the sludge riser pipe. The decanter can be raised or lowered, depending on the amount of sludge it is required to withdraw. The sludge is discharged into a concrete channel extending across the three compartments, from which it is piped to a sludge-return compartment.

Activated-Sludge Return

Sludge from the final settling tank is carried in an 8-in. cast-iron pipe to a chamber at the side of the sludge-digestion tank. This sludge chamber is provided with an air-lift pump, which raises the sludge to a distributing tank immediately above. The distributing tank consists of a concrete box containing the air-lift dome, baffle wall and weirs for the control of the sludge. An adjustable overflow weir is provided for the removal of excess activated sludge. This excess, with sludge from the preliminary settling tanks, is discharged directly into the sludge-digestion tanks.

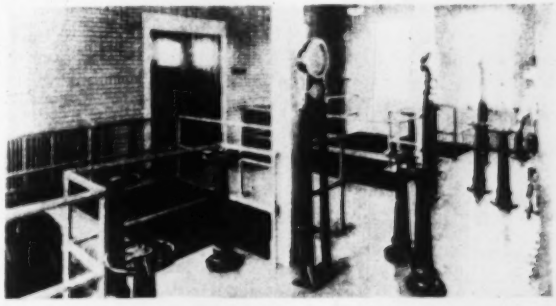
Rapid Sand Filters

The finally settled sewage spills over the rectangular weirs into a flume, from which it is piped to four 7x10-ft. rapid-sand filters equipped with rate controllers and loss-



Scrapers draw the sludge to a hopper at the end of the settling tank

At the right can be seen the glass-covered sludge bed. The aeration and digestion tanks are in the background.



Four rapid sand-filter units treat the activated-sludge effluent

Each filter is equipped with rate controller, loss-of-head and rate-of-flow gages and hand-operated gate valves. The filter effluent is chlorinated, with a 30-min. contact period in a concrete tank, before discharge into a small stream.

of-head and rate-of-flow gages. Sewage flows downward through the filters and rate controllers into a common effluent main leading to the contact tank. A concrete weir wall is provided at the end of the effluent main to seal the filters. The rate controllers are equipped with automatic throttling devices to close them whenever the rate of flow to the filters is less than the rate set. The nominal rate of filtration is 1½ gal. per sq.ft., or about 94,000,000 gal. per acre per 24 hours.

Water for washing the filters is taken from the effluent end of the contact tank by a motor-operated washwater pump with a capacity of 1,000 gal. per min., equivalent to a 24-in.-per-minute rise. Washwater troughs empty into a storage tank under the filter units with a capacity equivalent to three 6-min. washes. The waste washwater is pumped back to the clarification tanks for further treatment.

The filters are housed in a brick and stone building. The air compressors and air receiver for operating the plant's air-lift sludge pumps are located in the pipe gallery, and an extension is made in the gallery for housing the chlorinator equipment. The building is equipped with laboratory and sanitary facilities.

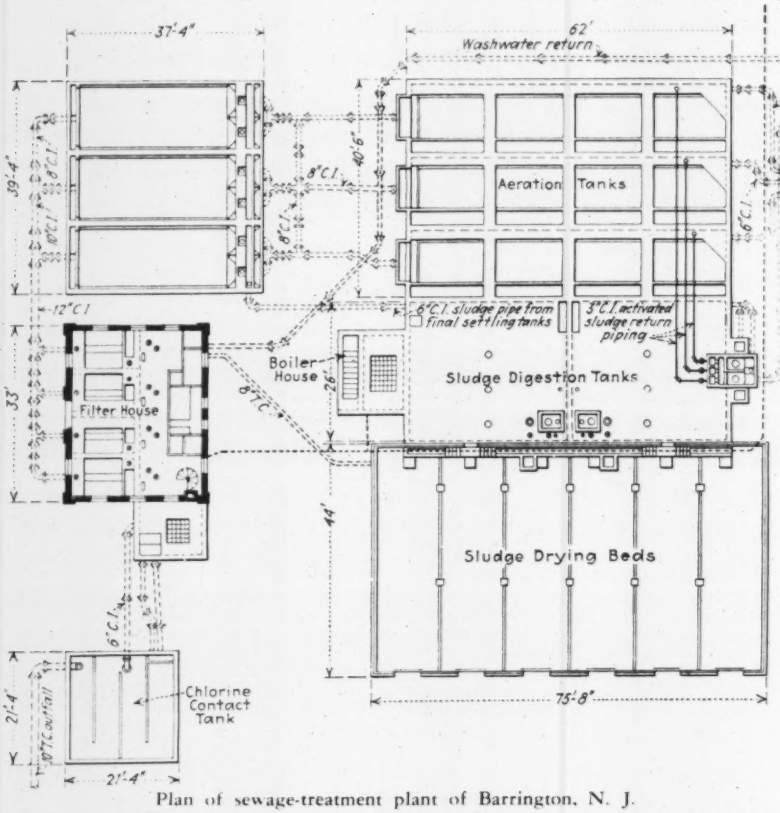
The contact tank is 20 ft. square by 6¼ ft. deep, with a concrete seal box at the inlet and a 10-in. bellmouth outlet, the top of which is set at the level of the sewage. During the washing of one filter the level in the contact tank drops about 2 ft. The discharge line is a 10-in. cast-iron pipe extending into the brook, and it discharges at a small dam across the stream, forming a small impounding reservoir submerging the outfall sewer.

Sludge-Digestion Tank

The sludge-digestion tank is divided into two compartments, each 26x30 ft. and 9 ft. deep. They are of the around-end-baffle type, with four passes, each 6½ ft. wide. Raw sludge and excess activated sludge are discharged from the sludge-diversion chamber to the influent end of each compartment. Digested sludge is withdrawn from the opposite end under a head of 4 ft. and is discharged into the sludge channel of the sludge-drying beds.

Heating coils are placed on the bottom of the first three passes of each compartment. The coils have area sufficient to maintain the average temperature in the digestion tank between 75 and 80 deg. F. Gas domes are provided in the roof of the tank compartments to collect the gas evolved during the digestion of the sludge. The gas piping from the domes is connected to a firetrap, a condensation drip, a pressure-relief trap and a gas meter to a gas-fired hot-water boiler. Water is circulated through the system by means of motor-operated centrifugal pumps. The boiler is automatically regulated to maintain a water temperature of not over 120 deg. F.

An air-lift foot piece is provided at the sludge outlet to lift some of the digested sludge to a compartment on the roof of the tank, from which it flows back to the influent end of each compartment to seed the entering raw and activated sludge. The air lift can also be used to empty either compartment or to transfer sludge from one to another.



Plan of sewage-treatment plant of Barrington, N. J.

Compactness and adaptability to landscape planting were had in mind in the layout.

Supernatant liquor is removed by a rotary decanting valve, provided with inlets spaced on 6-in. centers. The liquor is piped to an inspection manhole and then discharged into the waste washwater storage tank under the filters.

There are six glass-covered sludge-drying beds, each 12½x44 ft. The beds consist of sand supported by gravel, with open-joint tile drains. The drained liquor is also piped back to the washwater storage tank under the filters.

Physical Conditions

The site on which the plant is constructed is adjacent to property bought by the borough for a recreation center and park, and it was essential that the appearance of the plant should belie its purpose. The various units were arranged as compactly as possible and in a manner that will lend itself to additional landscaping when required. The filter building presents a pleasing appearance with the rest of the plant in the background. Wide driveways and gravel and walkways were constructed around the plant and trees, and shrubbery and flowers are planted around the various structures.

The plant was designed to serve a rapidly growing community. Naturally the sewage flow is considerably less than the designed capacity. After fifteen months of operation (end of July, 1931) the average sewage flow is only 160,000 gal. per day. This is partly due to the incompleteness of house connections and to the tightness of the sewer system. However, only one of the aeration and final settling-tank compartments and one filter bed are in operation, so that the results being obtained can be taken as a criterion of what the plant can accomplish when operating at full capacity.

Numerous tests have been made by disinterested parties. A test by Michael J. Blew, Major, Sanitary Reserve, U. S. Army, gave the following results:

	Suspended Solids, P.P.M.			Five-Day Biochemical Oxygen Demand, P.P.M.	Bacteria per Milo Liter (c.c.)	
	Total	Volatile Matter	Ash		Total	B. Coli
Influent	2,015	1,610	405	550	355,000	122,000
Final settling tank effluent	8	Trace	Trace	Less than 1	28,000	9,000
Sand filter effluent	2	Trace	Trace	Less than 1	0	0

In his comments Major Blew stated that the influent was septic and very concentrated, and that some persons may question the veracity of the suspended solids in the influent being as high as indicated. Adopting a figure of one-half, or even one-quarter of the figure given, still indicates an excellent removal. On a relative stability test a sample stood up for a period of 101 days without changing color, with an incubation temperature above 20 deg. He further stated that the effluent met all the requirements of a drinking water standard.

The operating data given are from one of the tests conducted by Major Blew. All of the tests run by Major Blew and others interested in the operation of this plant, as well as the tests run during normal operation, check more or less with the results given in the above tabulation. Suspended solids naturally vary, and I have only given the 2,015 p.p.m. reported by Major Blew because of the fact that it was a part of his original investigation. The sewage is very concentrated, and suspended solids vary from 500 to 1,000 p.p.m., depending on the method used in securing samples.

The plant was designed by P. B. Streander, associate engineer with the consulting engineers, Kennington, Vosbury & Goff, Camden, N. J.

New Hampshire Bypass Road Requires Unusual Structure

Grade separation over stream provided by double-deck steel bridge with four traffic interchange ramps

By JOHN W. CHILDS
Bridge Engineer, New Hampshire Highway Department, Concord, N. H.

THE CUTOFF ROAD that bypasses through traffic around the little village of Suncook, as shown by the accompanying map, is typical of the policy of the New Hampshire highway department to eliminate places of congestion and danger on its heavily traveled tourist roads. This particular undertaking, however, is exceptional in the complexity of the hazards done away with and in the expense of the structures required, one of which is a two-level bridge separating the roadways of intersecting highways. The accompanying drawings show the plan and main construction details.

Conditions at Suncook

Between Manchester and Concord the Daniel Webster Highway, which traverses New Hampshire from south to north, carries a traffic up to a normal maximum of 13,000 cars a day. Suncook is located on this section of the road. The road in the village, and for a mile or more adjacent to it, is composed of steep grades and sharp curves, with two electric railway crossings and a railway grade-crossing at its intersection with the Suncook Valley Railroad. The main street is so congested by the electric railway line and local automobile parking that it has not been uncommon to have on holidays a temporary blockade of through-traffic for a long distance both north and south. At certain hours there is a daily interruption in the flow of traffic through the village, with all the attending elements of danger incident to such congestion. To add to this congestion, route 28 (the Suncook Valley Road) leads off to the northeast to Wolfeboro, Alton Bay and the east end of Lake Winnepesaukee, thence to the East Side Trunk Line at Ossipee, which leads through the White Mountains to join the Daniel Webster Highway, or U. S. Route 3, at Colebrook beyond Dixville Notch. This junction at Suncook is at the most compact section of the village and has become a sorting point for northbound traffic to the lake regions and mountains and a merging point for southbound traffic returning toward Boston or other southern points.

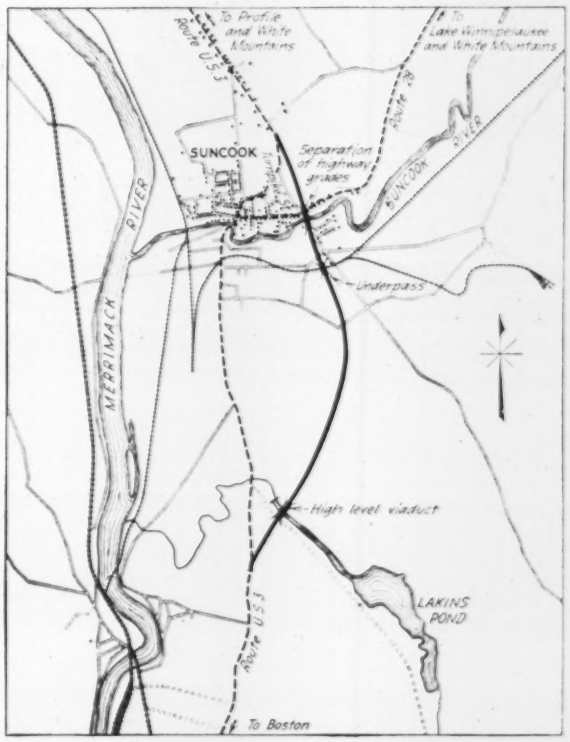


Fig. 1—Suncook bypass on Daniel Webster Highway, New Hampshire

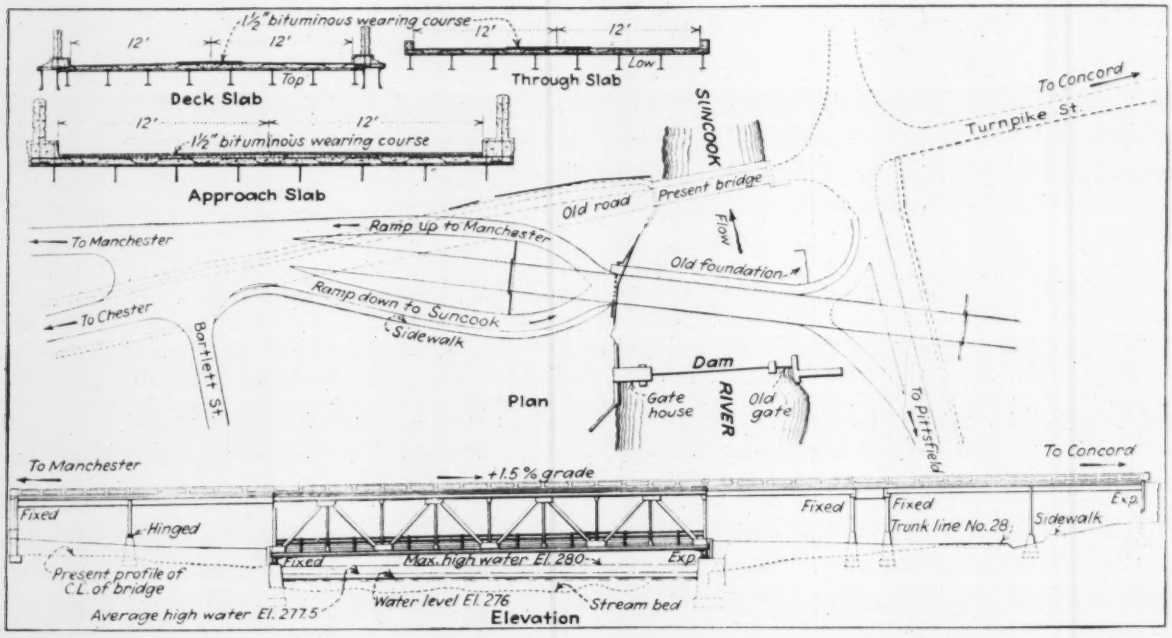


Fig. 2—Plan and structures of overstream highway intersection at Suncook, N. H.

The Suncook bypass was authorized and the plans were completed in 1930. It includes about 2½ miles of new highway, with a 300-ft. concrete viaduct across Lakins or Heads Pond, a concrete underpass under the Suncook Valley branch of the Boston & Maine Railroad and a two-level highway bridge over the Suncook River.

The new road leads off from the main highway route (U. S. No. 3) some 2 miles south of Suncook Village and follows a route of easy alignment and grade to the junction with route No. 28 at the Suncook River bridge, about a half mile east of the present junction point, thence north to join the present main highway about a half mile north of the village.

Contracts for the three principal structures were let early in 1931, and work was begun during the first part of May. The underpass was completed July 1, at a cost of $12,000. The concrete viaduct will be completed by Sept. 1, at a cost of $23,000. The bridge over Suncook River forming the separation of grades between U. S. Route No. 3 and No. 28 will be completed by Sept. 1, at a cost of $60,000. The contract for the road work will be let so as to complete the entire project during 1931. The estimated cost of the entire project is $250,000.

Two-Deck Intersection Bridge

The structure at the junction of the two main highways performs the double duty of bridging the Suncook River and eliminating a highway grade-crossing of two trunk lines. The bridge is a through-steel truss (Fig. 2) serving the lower, or route No. 28, level, with a deck roadway above at the level of the Daniel Webster Highway grade. The main bridge has a clear span of 143 ft. There are two 50-ft. approach spans on a steel bent at the south end and three 50-ft. approach spans at the north end, all made up of rolled shapes. The roadways of both levels are of reinforced concrete having a clear width of 24 ft. The foundations of the main span are on solid ledge, and the piers and abutments of the approach span are set on hardpan or ledge. The total structure includes 1,344 cu.yd. of concrete and 56 tons

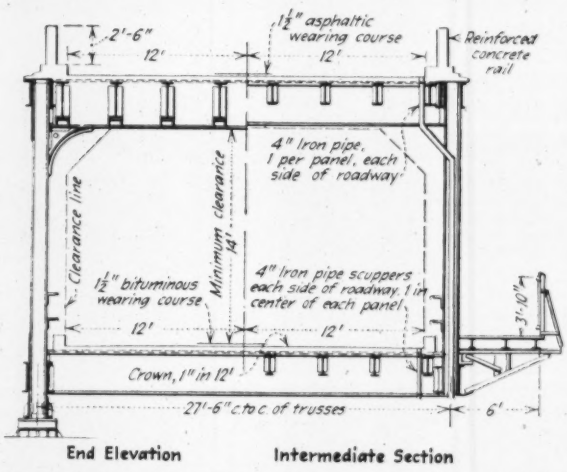


Fig. 3—Deck arrangement, grade-separation bridge at Suncook

of reinforcing steel and 334 tons of structural steel.

Local features as to topography and the nature of the traffic to be served largely governed the development of this type of structure. All local traffic emanating from Suncook Village will be served by the present highway joining the trunk line north and south of the village. There is practically no traffic from route No. 28 north to Concord; and should any of this sort develop, it would be served by Turnpike St. Traffic from No. 28 southbound will cross the river on the lower level joining route 3 by a ramp at the right of the south bridge approach. Traffic from route 3 to route 28 will leave the main highway by a ramp down to the lower level, crossing the river at that grade. This arrangement is expected to sort the northbound traffic and assemble the southbound traffic with the least possible interruption in the traffic flow on the Daniel Webster trunk line on U. S. route No. 3.

The bypass road and structures were designed by the highway department engineers, Frederic E. Everett, commissioner, and state engineer.

Built-Up Wood Columns Conserve Lumber

Tests indicate that columns composed of odd-sized sticks fastened together may have 75 to 90 per cent the strength of solid timbers—Various types of fastenings

By JOHN A. SCHOLTEN
Forest Products Laboratory, Madison, Wis.

IN THE PRODUCTION of solid or one-piece wood columns and posts for building construction there is much material left that is of excellent quality but not of standard sizes and therefore likely to be wasted. These sticks and other odd-sized materials produced in the manufacture of standard sizes of lumber may be utilized by putting them together to form built-up columns. That such columns, made with suitable fastenings, may have a high ratio of strength in comparison with solid columns of the same cross-sectional dimensions is shown by the tests here described, including columns of different sizes and put together in different ways. Only mechanical fastenings—nails, bolts and dowels—were used in these tests, but others are to be made on columns having the sticks glued together. For this latter form of construction it would seem that the factor of friction between the component parts or sticks should be considerable, while with mechanical fastenings this factor is likely to disappear entirely with the slightest shrinkage in the sticks. In the days of sailing ships the lower portions of large masts were often composed of timbers fastened together with marine glue. Such masts were subjected to all kinds of climate and weather, as well as to the stresses caused by holding great sails full of a gale of wind, but it is said that in tests to destruction, fractures occurred in the wood rather than in the glued joints. The results of the tests here described are of importance to both the building industry and the lumber industry.

—EDITOR.

A STUDY of laminated or built-up wood columns indicates that columns composed of lumber of small dimensions can be built commercially to have more than 75 per cent of the initial strength of solid columns of the same size. Individual columns of some designs reach 90 per cent of that strength. Advantages of the built-up column include: (1) use of the same size of material for various sizes of columns; (2) ease of handling; and (3) the possibility of avoiding excessive checking and warping. There is the one disadvantage of requiring a slightly larger size than a solid column for a given strength. In view of its advantages the built-up or laminated column should receive more attention from architects, engineers and builders.

For the user, important advantages of the built-up column are that it may be made any desired length, the wood may be treated to resist fire and decay, and high-grade lumber may be reserved for the vital parts of a column section, with less expensive material filling the less important positions. For the mill man, laminated construction of any kind is an outlet for material left over in the manufacture of standard lumber.

For these reasons the Forest Products Laboratory, under an agreement with the National Lumber Manufacturers' Association, has carried out a series of tests to determine the strength of various types of built-up columns and to determine what types most nearly approach the strength of solid columns of the same cross-section. A built-up column ideally assembled with glue would approach the strength of a solid column. In the tests here described, however, the purpose was to determine the strength of columns assembled with nails, bolts and metal shear keys or dowels.

Columns Tested—Two sizes of columns were tested, 4x4 in. and 8x8 in. in cross-section. Of the smaller columns, which were made of spruce, 32 were tested in 8-, 6-, 4- and 2-ft. lengths. Of the larger ones, made of Douglas fir, fourteen were tested in 16-, 8- and 2-ft.

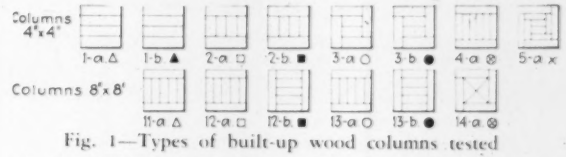


Fig. 1—Types of built-up wood columns tested

1a: four laminae, 1x4 in., nailed. *1b:* four laminae, 1x4 in., bolted plus nails. *2a:* four laminae, 1x2 in.; two coverplates, 1x4 in., nailed. *2b:* same as *2a*, nailed plus bolts and metal dowels. *3a:* four laminae, 1x3 in.; two laminae, 1x2 in., nailed. *3b:* same as *3a*; nailed, plus bolts and metal dowels. *4a:* six laminae ⅝x2½ in.; two coverplates, ⅝x4 in., nailed. *5a:* four laminae, ⅝x3¼ in.; four, ⅝x2 in., and two ⅝x¾ in., nailed. *11a:* five laminae, 1½x5½ in.; two coverplates, 1½x8 in., nailed. *12a:* same as *11a*, but with nails driven in bored holes. *12b:* same as *12a*, but with axis rotated 90 deg. *13a:* same as *12a*, but butt-jointed. *13b:* same as *13a*, but with axis rotated 90 deg. *14a:* one timber, 5x5 in.; four laminae, 1½x6½ in., nailed.

lengths. At least one length of each size falls in the long-column class, where the strength depends upon stiffness; another in the short-column class, where the strength depends primarily upon the crushing strength of the wood; and still another in the intermediate class, where the strength depends upon a combination of stiffness and crushing strength.

The length classification of a column is determined by the size and shape of its cross-section as well as its actual length; the value used is called the "slenderness ratio." In the test columns the boards or laminations were arranged in various ways (Fig. 1) but were of full length, except that columns *13a* and *13b* were in two butt-jointed pieces.

Fastenings—The arrangement of nails, bolts or other metal fastenings is indicated in Fig. 2. For the 4x4-in. columns, 8-penny nails were selected. In all instances the nails for three or more parallel laminations were long enough to enter the third lamination. Bolts were ½ in. in diameter and were supplemented by a few 8-penny nails in the outer laminations and coverplates. For the 8x8-in. coverplate type of columns 20-penny nails were used in the outer boards and 16-penny nails in the inner boards, staggered in position with the outer nails. For the solid-core box type of large column 20-penny nails were used.

Method of Loading—A solid column when ideally loaded may be in unstable equilibrium and consequently may be sustaining more than its calculated load. But in

the average commercial column any departures from ideal behavior are caused by such factors as eccentricity of loading, lack of straightness and variation in modulus of elasticity. To reproduce actual conditions in the tests and to prevent unstable equilibrium, all columns were loaded with some eccentricity (0.04 in. for the smaller and 0.07 in. for the larger columns) through pin-ended bearings. Eccentricity causes a reduction in load capacity that is especially noticeable in the intermediate length of column, but it has a diminishing effect with an increase or decrease in length. In a laminated column the effect of eccentricity is more pronounced than in a solid column, because the former has less resistance to the longitudinal shear that is introduced as soon as any bending occurs.

The percentage reduction in the strength of a solid column that should be expected from the eccentricities used is shown by the curve *A* in Figs. 3 and 4. Curve *B* in both figures gives the expected performance under ideal loading of solid columns. It is a calculated combined eighth-power and Euler curve, based on the control specimens and assuming a compressive strength parallel to grain of 5,000 and 6,350 lb. for the 4x4-in. and 8x8-in. columns, respectively. The curve for eccentric loading *C*, however, which was calculated from Curve *B*, gives the expected performance of solid columns loaded with the eccentricities selected. The test results for each laminated column were reduced to percentage values of the calculated results for a solid column having the average properties of the wood in the laminated column. These results were then transferred to Figs. 3 and 4 in such a manner as to bear the same relation to curve *C* as to their own ideal curves. The ratios presented here and in the accompanying table are expressed in terms of an ideal curve adjusted for eccentricity.

STRENGTH OF LAMINATED WOOD COLUMNS

(The strength is given in percentage of the strength of eccentrically loaded solid columns of the same external dimensions.)

Type of Column	Number in Figs. 3 and 4	Strength at Slenderness Ratios of 12 to 24 Per Cent
	4 x 4-in. Column	
Laminations face to face	1*a*, 1*b*	27 to 37
Coverplate type, 1-in. coverplate	2*a*, 2*b*	49 to 73
Coverplate type, ¾-in. coverplate	4*a*	63 to 78
Varied arrangement	3*a*, 5*a*	63 to 78
	8 x 8-in. Column	
Coverplate type	11*a* to 13*b*, inclusive	67 to 90
Boxed core type	14*a*	74 to 91

Arrangement of Laminations — Columns built of laminations simply arranged face to face showed strengths only about 27 to 37 per cent of those for the solid stick in the practicable range of slenderness ratios. For short posts the ratio is about 75 per cent. By tying the laminations together with wood coverplates (columns 2*a* and 2*b*, Figs. 1 and 3) the load-carrying capacity was increased to a range of about 49 to 73 per cent in the slenderness-ratio of 12 to 24, and from 69 to 85 per cent in the short column class. It is apparent, therefore, that for most purposes the columns with coverplates are superior to the others.

When the thickness of the coverplate was reduced from 1 in. to ¾ in. (type 4*a*, Figs. 1 and 3), the column was more nearly equal in strength about both axes. This increased the strength of the column, which then ranged from 63 to 78 per cent in the same range of lengths. As before, a greater strength was obtained in the short-post class. In all these columns (1*a* to 2*b* inclusive and also 4*a*, Fig. 1) the lowest percentage of the strength of the solid stick of the same size was obtained at a slenderness ratio of 18.

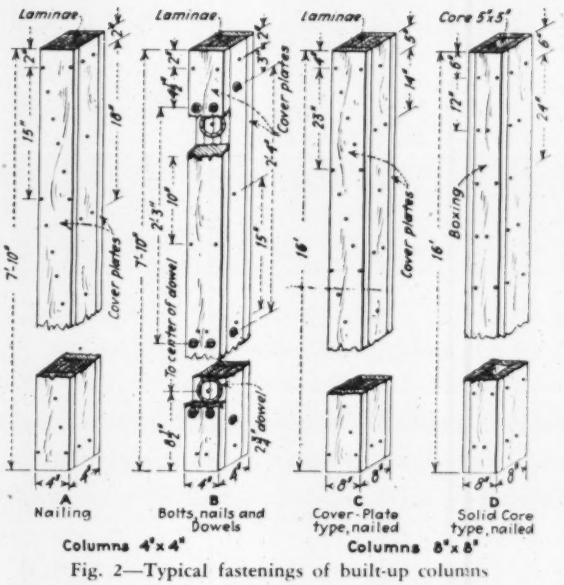


Fig. 2—Typical fastenings of built-up columns

A: nailing for 4x4-in. column. *B*: bolting, nailing and doweling 4x4-in. column. *C*: nailing for 8x8 in. coverplate column. *D*: nailing for 8x8-in. solid-core columns.

Columns with the laminations interlocked or arranged, as in 3*a* and 5*a* of Figs. 1 and 3, although not carrying so great a load at some lengths, carried a greater load than the plain coverplate type at a slenderness ratio of 18. The loads varied from 63 to 72 per cent for column 5*a* in the 12 to 24 range in slenderness ratio, while for column 3*a* the loads varied from about 63 to 78 per cent in the same range. This type of column however, has the disadvantage of being more difficult to build; it also requires more material, since the laminations are not of commercial dimensions.

All the larger columns of Fig. 4, except 14*a*, were of the coverplate type (Fig. 1). The percentages of solid-column strength varied from 67 to 81 at a slenderness ratio of 12 to between 72 and 90 at 24. For column 14*a*, having a solid core, the results varied from 74 per cent at a slenderness ratio of 12 to 91 per cent at a ratio of 24. This type of column, beside giving as good results as the others in certain lengths and better results in one length, lends itself to the possibility of boxing good or fireproofed material around a low-quality core. The outstanding results for the various arrangements of laminations are summarized in the table.

Joints in Laminations—Butt-joining the laminations (types 13*a* and 13*b*, Figs. 1 and 4) in a column having a slenderness ratio of 24 affected the results very little, except that it tended to lower the loads when the coverplates were perpendicular to the axis of deflection. In the shorter columns, however, where the stress is primarily compression, a noticeable reduction in load was obtained, because of the fact that when the ends of boards are butted together they become embedded, and in consequence the maximum crushing strength is never above 75 to 80 per cent of the maximum crushing strength obtained between wood and a metal bearing plate.

Comparisons of Fastenings—In a solid column the shear distortion, which occurs as soon as bending is introduced, takes place between the wood fibers; in a laminated column it tends to take place between the laminations. The chief function of the nails, bolts and other metal fastenings is to resist this distortion. Nails come into

play sooner than bolts. But with any kind of fastening the large distortions accompanying appreciable loads are considerably greater than the distortion of the wood itself under shearing stresses and also greater than the small amount of distortion between the laminations before the ultimate load is reached. This condition allows the column to fail before the maximum effect of the fasteners is realized.

Comparison of *a* and *b* columns of Fig. 3, especially 1*a* and 1*b*, shows that the nailed columns generally sustained a greater load than the bolted columns. These results might have been different for other bolting or nailing arrangements, but that is unlikely since the fastenings were sufficient in number and so well placed as to afford a fair comparison between the two types. Incidentally, it was found that decreasing the nails to half the number of Fig. 2 reduced the ultimate strength about 25 per cent. On the other hand, it does not appear that an increase in the number of nails would increase the strength in the same ratio.

At one slenderness ratio the columns assembled with nails driven into bored holes were slightly superior to

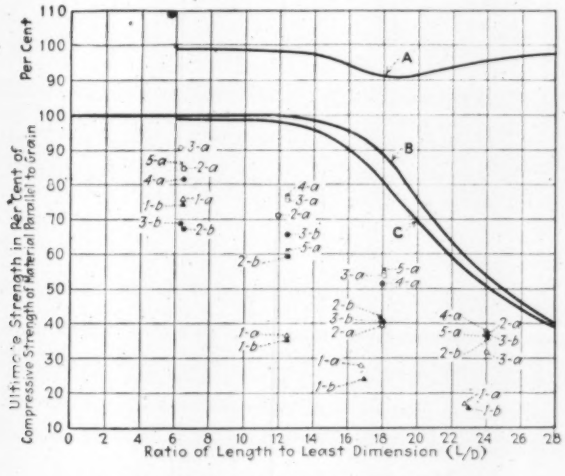

Per Cent
Ultimate Strength in Per Cent of Compressive Strength of Material Parallel to Grain
Ratio of Length to Least Dimension (L/D)
A
B
C

Fig. 3—Tests on 4x4-in. built-up columns

Results given in comparison with calculated strength of solid columns of same size. *A:* ratio of maximum load of solid column with 0.04-in. eccentricity to maximum load of solid column with no eccentricity. *B:* solid column, Euler and eighth-power curve. *C:* solid column with 0.04-in. eccentricity, calculated.

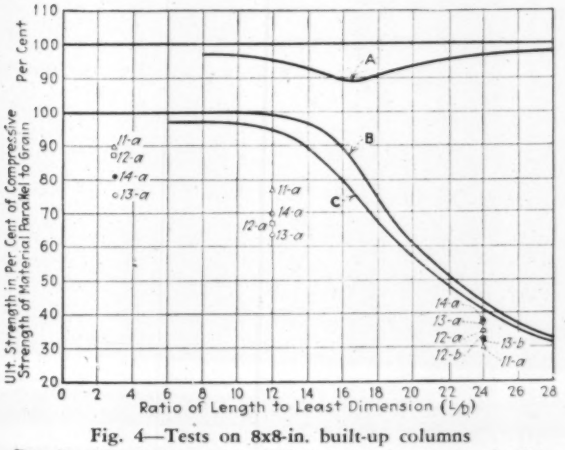

Per Cent
Ult Strength in Per Cent of Compressive Strength of Material Parallel to Grain
Ratio of Length to Least Dimension (L/D)
A
B
C

Fig. 4—Tests on 8x8-in. built-up columns

Results given in comparison with calculated strength of solid columns of same size. *A:* solid column with 0.07-in. eccentricity in per cent of solid column with no eccentricity. *B:* solid column, Euler and eighth-power curve. *C:* solid column with 0.07-in. eccentricity, calculated.

columns having nails driven into solid wood (types 11*a* and 12*a*, Figs. 1 and 4). At another slenderness ratio the former were slightly inferior. The results are not considered significant of any difference. When using special metal dowels or shear keys, in conjunction with a few bolts and nails (types 2*b* and 3*b*, Figs. 2 and 3), the results were generally lower than those for the same type of column well nailed.

Just how much of the load capacity of a built-up column is due to friction between the laminations is difficult to determine. But evidently most of the resistance to shear in a bolted column is due to friction, whereas in a nailed column it is due both to friction and to the lateral resistance of the nails. The friction element is one that cannot be safely counted upon, since any shrinkage subsequent to assembly would eliminate it entirely.

Conclusions—No arrangement of laminations or kind of mechanical fastenings used in laminated columns gave results fully equal to those for solid sticks. Considering only the test results of columns with slenderness ratios of 12 to 24, the small-sized columns of pieces assembled face to face gave about 33 per cent of the strength of a solid column. Tying the edges together with coverplates of such size as to have the moment of inertia practically equal about both axes, or arranging the laminations as in 3*a* and 5*a* of Figs. 1 and 3 increased the strength to about 66 per cent of that of a solid column.

In the columns of larger size the type having plain coverplates and a moment of inertia equal about both axes carried about 80 per cent of the load of a solid column, while the columns with a solid core averaged slightly more than 80 per cent. These values apply when the wood is well seasoned and the columns are built under engineering supervision. Some of the load sustained by the built-up columns is due to friction, although it is difficult to say how much. However, the most efficient columns are those least affected by moisture changes subsequent to assembly.

Future Work—Tests will be continued on the two most promising types: (1) the solid core boxed with planks; and (2) the laminations with coverplates. These further tests are to develop optimum nailing schedules and to determine the maximum economically permissible substitution of low-quality for high-quality lumber. They will also furnish further evidence of the efficiency of these types of built-up columns.

Escalators for Two New Buildings

Moving stairways or escalators are to be utilized as supplements to the regular elevators in the new 28-story annex building of the Metropolitan Life Insurance Co. and the 67-story Cities Service Building in New York City. In the Metropolitan Life building three floors of dining rooms, below street level, will be served by escalators. In the Cities Service Building the escalators will serve six floors above the street, where large clerical forces will be concentrated. The escalators do not require a great amount of floor space and move large numbers of people rapidly and satisfactorily. In general the escalators will be run in the direction of greatest traffic flow. When there is no predominance of traffic in one direction some of the escalators will operate upward and some downward. Escalators have been used previously in department stores to serve as many as twelve floors, but these are believed to be the first office building installations.

Possibility of Improvement in Timber Framing Reviewed

Forest Products Laboratory finds that structural research in timber construction has been neglected—Recent developments show possibilities for economic use

BUILT-UP WOOD COLUMNS, discussed in the preceding article, are but one instance of the possibilities for more economical use of wood than have been practiced in the past. Other possibilities were reviewed in a paper entitled "Recent Developments in Timber Framing," by George W. Trayer, senior engineer of the Forest Products Laboratory, U. S. Department of Agriculture, published in the 1931 *Proceedings* of the Engineers Society of Wisconsin. An abstract from the paper is given herewith.

—EDITOR.

SOME CHANGES in timber-framing practice have come in the past ten or fifteen years, most of which have been brought about through a demand for economy of material and labor. Structural research, however, has not kept pace with this rule-of-thumb development, and economy in first cost has too often been obtained at the expense of strength and stability. Hence, structural research of fundamental character is needed in this field. In Europe, timber design has undergone radical changes within the past ten years, so that not only local lumber but also that imported from the United States is now competing effectively with other materials of construction produced locally.

Joints and Fastenings—In wood construction, joints and fastenings form the greatest source of weakness. Timber of small dimensions is usually joined by nails, and that of larger dimensions by bolts or other metal fasteners. Fairly complete data are now available on withdrawal resistance of nails, while tests of lateral resistance of nailed joints cover a wide range of nail sizes and species of wood.

Widely used handbooks on the design of a simple bolted tension joint show a range of over 600 per cent in the working loads recommended by various authorities, but the Forest Products Laboratory has completed extensive tests on the bearing strength of wood under common steel bolts, from which dependable working loads have been derived. A variety of metal fasteners used extensively in Europe to increase the efficiency of bolted joints are being tested. Preliminary results indicate that with the best of these fasteners, which act somewhat like dowels or keys, the strength of a bolted joint can be increased enormously.

Laminated Wood Construction—In this type of construction several pieces of wood are so joined that the grain of all pieces runs in the same general direction. The laminae may be glued, nailed, bolted, or joined by a combination of these methods. This construction is becoming increasingly general; its particular merit hinges both upon the possibility of utilizing thoroughly dry, short-length, small-dimension material and upon the effective placement of the best material.

In the design of laminated columns, tests have shown that with good nailing about 80 per cent of the strength of a solid piece of comparable quality can be obtained. Laminated beams and girders in which the plane of each joint between faces is vertical have long been used. Ordinarily the laminae of such members are either nailed or nailed and bolted. Tests are being conducted on glued laminated beams that have the joint planes horizonta This construction offers the possibility of putting high grade material in the upper and lower laminae and poore material near the neutral axis.

Bowstring wooden trusses with laminated upper chord have become increasingly common. The upper chor which is arched, is built up of a series of long lengths o 2-in. lumber, superimposed and either nailed, bolted an glued, or nailed and bolted together. These arches ar assembled around a form and retain their curvature whe removed from it. Two such laminated arches spaced t receive the web members constitute the upper chord o the truss. The web members are usually solid. Th lower chords consist of two or more pieces conveniently spaced to receive the web members, and spliced with wood fishplates at intervals, according to the span Practically no dependable design data are available o this adaptation of laminated construction.

Laminated construction is found also in Gothic barn roof construction. The barn-roof truss has evolved from the heavy-timber type to much lighter types of construction, one of which is the laminated arch. Here 1-in material is common, and usually four or five laminae are bent around a form and nailed together to form an arch Where these arches (spaced about 2 ft.) are not sufficiently rigid to make the roof self-supporting, it is common practice to use a segment arch in place of every fourth laminated arch; the segment arches have their face joints vertical. The laminae consist of a series of segments cut from 1-in. stock and nailed face to face. Sometimes segment arches, spaced 2 ft. apart and only two or three laminae thick, are used throughout the roof.

Both of these types of construction represent a great economy of material in that short-length, narrow and relatively low-grade material may be utilized. A relatively modern European development consists of large laminated arches that are glued. Small stock reduces the stresses induced in bending the laminae to form. This type of construction has not yet been introduced into the United States. The fundamentals of the laminated arch are not well understood and much research work needs to be done before efficient and safe design can be worked out.

Lamella Roof Construction—This type of framing is particularly suited to the requirements for large and unobstructed floor areas. It makes use of two simple engineering devices—the arch and the triangle. The framing is made of relatively short timbers, varying in section from 2x8 in. to 3x16 in., and in length from 8 to 14 ft.; these are bolted together to form a network. The lamella roof, invented in Germany about 1923, was first introduced into this country in 1925. Among the principal structures so far built is the auditorium at Houston, Tex. (*ENR*, May 24, 1928, p. 815.)

New Railway Bridge in Canada

On July 20 the Pacific Great Eastern Railway opened a new railway bridge across the Fraser River at Lillooet, Canada. The bridge was constructed by the Dominion Bridge Co., Ltd., and was completed six weeks ahead of schedule. Formerly passengers for Lillooet had to disembark at Seton Creek Lodge and take a bus to town while the train meandered across an old trestle over Seton Creek, later crossing the Fraser River by a low-level bridge. Erection of the new bridge will give speedier and better service to this section of the country.

Design of a Concrete Bowstring-Arch Bridge, Including Analysis of Theory

Type of structure uncommon in United States used on Oregon state highway—Foundation and climate determining factors—Temporary hinge used in arch ribs—Tied arch analyzed for load, temperature and shrinkage stresses

By CONDE B. McCULLOUGH
Bridge Engineer, Oregon State Highway Commission

RARELY USED in the United States, in comparison to its applications in Europe, a bowstring-arch design of reinforced concrete was used, because of foundation and climatic conditions, for the Wilson River bridge being built by the Oregon state highway commission. The structure consists of a pair of arch ribs for a 120-ft. span carrying a suspended through-roadway deck with arch reactions taken by the reinforced-concrete floor slab acting as a tie, thus converting the structure into a completely closed ring supported on vertical piers. The structural elements, which differ from standard arch-design practice, and the analysis of the tied-arch theory are described in the following.

Location of the bridge near the coast, where corrosion of steel is severe, dictated a concrete structure in accordance with the practice of the highway department for such conditions of coast exposure. The economy of concrete in this position, other considerations being equal, is due primarily to maintenance cost of painting steel structures. The type of concrete structure to be used was influenced by foundation conditions, which rendered abutments capable of sustaining arch thrust uneconomical, and the relation of high-water level to roadway grade, which eliminated deck-girder construction for the 120-ft. span, even if such construction had been economical.

Design Features—The axial rise of 36 ft. for the arch was based on an economic balance between lateral thrust components, which influenced the design of the tie and concrete yardage in the ribs. In addition, a rather high rise allows a more rigid system of bracing. The curve of the arch is not a simple second-degree parabola frequently used for this type of loading, but the exact locus of computed points on the equilibrium polygon. This type of curve has been employed by the writer's office on several jobs and has been termed the "multi-parabolic axis," because its equation consists of the algebraic sum of parabolas of different degrees from the second degree to that represented by the number of panel points in the half span.

The ribs are 3 ft. 6 in. wide by 2 ft. 8 in. thick at the crown and 3 ft. 6 in. thick at the springing. Arch reinforcing consists of sixteen $1\frac{1}{8}$-in. square bars per rib. Additional $1\frac{1}{4}$-in. square bars at the ends of the ribs are fanned out diagonally into the floor to transmit the thrust back into this 12-in. slab, which is used as the tie member. Arrangement of this diagonal tie steel is shown in the accompanying detail. The transverse component of this tension is taken by transverse tie steel of 1-in. bars (see same detail). This scheme of transferring arch thrust into the tie, of course, is only one of many possible methods. For example, the tension rods could be placed in a beam along the curb instead of spreading them out into the slab. Preliminary studies, however, indicated that the method used was somewhat more economical of material.

The hangers, which are spaced at 12-ft. intervals, were designed as a relatively thin rectangular section, with a thickness of only 5 in. parallel to the axis of the roadway. This was done to avoid secondary bending stresses induced by angular distortion of the arch rib. Also, the hanger tops were articulated by means of asphaltic felt. Placement of hanger concrete will be deferred until the arch and deck falsework have been released and the hanger rods are under full dead load. In view of the experience with hanger members of this character, such a precaution appears necessary in order to avoid the formation of horizontal circumferential cracks.

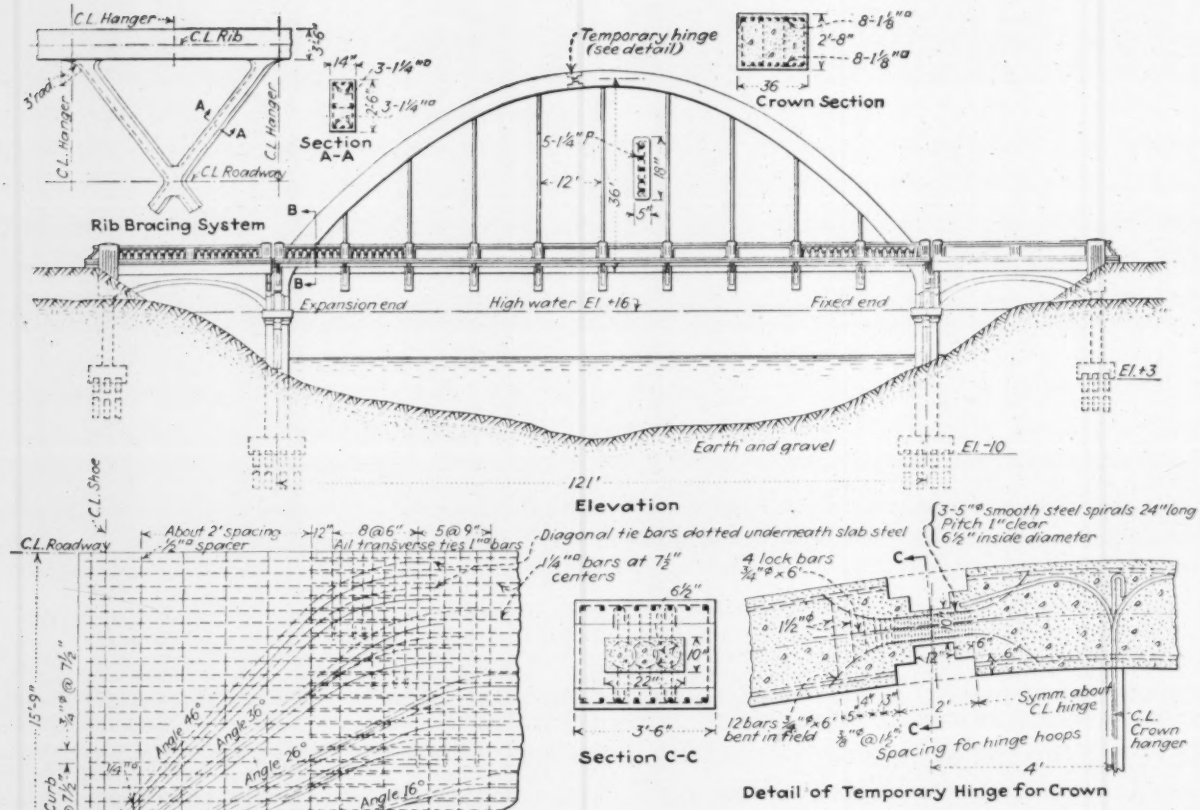
Another interesting design feature is the use of a temporary hinge in the ribs placed just off the crown section (see detail). A careful investigation of stress distribution indicated a distinct economy resulting from use of this hinge, which causes the arch to act as a single-hinged arch under dead load. The hinge will be keyed in solid after the rib has received full dead load, thus providing an unarticulated structure under live load.

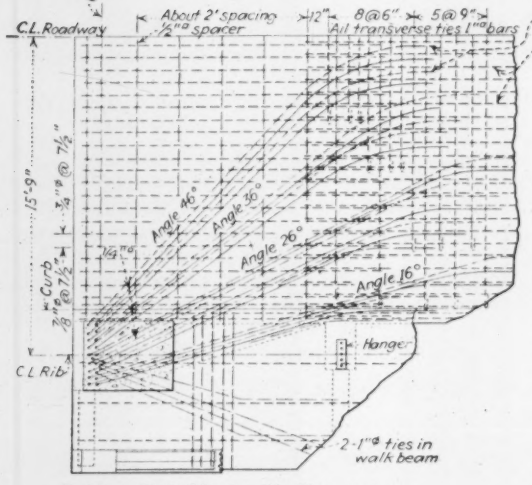
To determine a safe working stress for the crown hinge sections, tests were made on full-size hooped columns. The results of these tests indicate the high compressive strength developed in a tightly hooped column of this character.

Test No.	Longitudinal Bars	Spiral Hooping	Compressive Strength, Lb. Per Sq. In. Minimum	Maximum
1	6 ⅜-in.	¼-in	13,500	13,900
2	6–⅜ "	¼ "	14,200	14,800
3	6–⅜ "	¼ "	11,000	12,000
4	6–⅜ "	¼ "	13,300	14,400

Tied-Arch Theory—The basic theory of the tied arch is quite similar to that for the ordinary fixed-arch span, but it has distinctive elements. A development of the theory follows.

If the arch-rib tie (Fig. 2) is severed at any section (2–2) and if each of the severed ends is assumed connected to a rigid bracket terminating at some point O (later taken as the elastic center of the system), it is apparent that the structure may be maintained in equilibrium by the introduction, at point O, of three unknown force components, X, Y and Z, acting against each bracket as indicated. These three so-called redundant components may be so determined as to maintain the structure in exactly the same stress and strain condition as that which obtained with the unsevered tie. The original tied arch has therefore been replaced by a simple curved beam b–c with two interior cantilevered stubs, each terminating in a rigid bracket whose terminal point O is under the action of three redundant force components X, Y and Z. The value of these redundants may be readily determined from the obvious





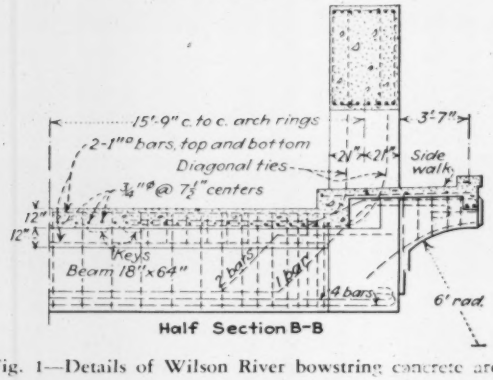


Fig. 1—Details of Wilson River bowstring concrete arch bridge

fact that points a and d have no displacement, either angular or linear, relative to each other.

If Δ_x, Δ_y and Δ_z represent the displacement components of point O along the direction of action of the three respective redundants, we may write:

$$\Delta_x = 0,\ \Delta_y = 0 \text{ and } \Delta_z = 0 \qquad (1)$$

But $$\Delta_x = \Delta_{ox} + X\delta_{xx} + Y\delta_{yx} \times Z\delta_{zx} \qquad (2)$$

wherein Δ_{ox} represents that portion of the displacement caused solely by the external loads, and δ_{xx}, δ_{yx} and δ_{zx} represent the displacement components (measured in the direction of the redundant X) that would be caused by the forces X = unity, Y = unity, and Z = unity, respectively, all forces being assumed as acting on the severed or statically determinate rib.

If point O for each bracket be taken as coincident with the elastic center of the system (the center of gravity of the elastic loads $G = \frac{ds}{EI}$) the term δ_{xz} vanishes and (since the arch is symmetrical) by taking the redundant axes X–X and Y–Y as horizontal and vertical the term δ_{xy} may also be made to vanish. (This fact is demonstrated in the writer's treatment of arch bridges in Hool & Kinne's "Reinforced Concrete and Masonry Structures.")

From equations (1) and (2), therefore, we may write:

$$\Delta_x = \Delta_{ox} + X\delta_{xx} = 0 \qquad (3)$$

or $$X = \frac{-\Delta_{ox}}{\delta_{xx}} \qquad (4)$$

in a similar manner

$$Y = \frac{-\Delta_{oy}}{\delta_{yy}} \qquad (5)$$

$$Z = \frac{-\Delta_{oz}}{\delta_{zz}} \qquad (6)$$

Equations (4), (5) and (6) are entirely general and hold for any condition of loading or for any other straining agency such as temperature variation and shrinkage. The numerator in each case represents the displacement component (measured along the direction of action of the particular redundant force considered) caused by the external straining agency (loads, temperature, etc.) acting upon the severed frame, while the denominator represents the corresponding displacement caused by a unit value of the redundnant force in question.

To transform these equations into terms representing the known loads and dimensions of the structure, we will consider the following cases:

Case I—Gravity loadings

If two auxiliary loads (X = unity) be applied at the bracket terminals, as indicated in Fig. 2, and if (n_x) and (m_x) represent, respectively, the axial thrust and bending moment at any section induced by this pair of loads, we may write (from the well-known formula for elastic displacements):

$$\Delta_{ox} = \Sigma M_o m_x G + \Sigma N_o n_x \frac{ds}{AE} \qquad (7)$$

$$\delta_{xx} = \Sigma (m_x)^2 G + \Sigma (n_x)^2 \frac{ds}{AE} \qquad (8)$$

where M_o and N_o represent moments and thrusts caused by the external load system acting upon the severed rib.

Whence:
$$X = -\left[\frac{\Sigma M_o m_x G + \Sigma N_o n_x \frac{ds}{AE}}{\Sigma (m_x)^2 G + \Sigma (n_x)^2 \frac{ds}{AE}}\right] \qquad (9)$$

In a similar manner:
$$Y = -\left[\frac{\Sigma M_o m_y G + \Sigma N_o n_y \frac{ds}{AE}}{\Sigma (m_y)^2 G + \Sigma (n_y)^2 \frac{ds}{AE}}\right] \qquad (10)$$

$$Z = -\left[\frac{\Sigma M_o m_z G + \Sigma N_o n_z \frac{ds}{AE}}{\Sigma (m_z)^2 G + \Sigma (n_z)^2 \frac{ds}{AE}}\right] \qquad (11)$$

But from Fig. 2, considering moments causing compression in the outside of the ring as positive and vice versa,

$$\left.\begin{aligned} m_x &= +y \\ m_y &= +x \\ m_z &= \text{unity} \end{aligned}\right\} \qquad (12)$$

Also, $n_x = -\cos\theta$, $n_y = \sin\theta$, $n_z = 0$, $n_x ds = -dx$, and $n_y ds = dy$.

Furthermore, the second term of the denominators of equations (9), (10) and (11) is very small and may be neglected without any material error; whence we may write:

$$X = -\left[\frac{\Sigma M_o G y - \Sigma N_o \frac{dx}{AE}}{\Sigma G y^2}\right] \qquad (13)$$

$$Y = -\left[\frac{\Sigma M_o G x + \Sigma N_o \frac{dy}{AE}}{\Sigma G x^2}\right] \qquad (14)$$

$$Z = -\left[\frac{\Sigma M_o G}{\Sigma G}\right] \qquad (15)$$

In equations (13), (14) and (15) the factors M_o and N_o, representing the external loads, must include not only the gravity loadings acting downward but also the shoe reactions acting upward. These latter are statically determinate the same as for any truss or beam, and may be easily calculated for any position of the unit load when deriving the influence lines for the redundants X, Y and Z.

If the bending in the tie due to arch-rib deflection be neglected (which introduces no material error), the above equations enable the influence lines for the three redundant forces X, Y and Z to be constructed, and from these the stresses in the arch rib and tie may be determined for any condition of loading.

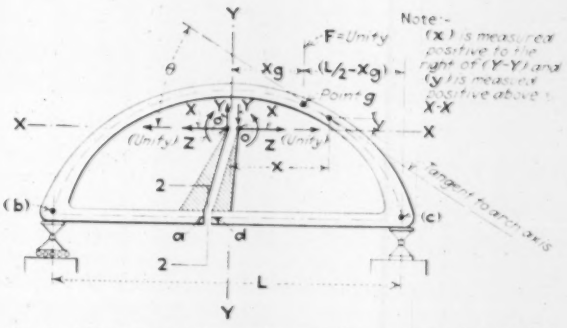


Fig. 2—Diagrammatic bow-string arch for mathematical analysis

Case II—Temperature and shrinkage effects

In this case $\Delta_{ox} = \Sigma n_x c t ds = \Sigma c t dx = 0$ (16)
(since the summation is for a closed ring).

Therefore, $X_t = 0$, and in a similar manner it may be shown that $Y_t = 0$ and $Z_t = 0$. The tied arch is, therefore, unaffected by a uniform change in temperature or a shrinkage of the material.

Conclusion—There is much to recommend the bow-string type of arch. It is reasonably economical of material, unaffected by temperature and shrinkage and adaptable to yielding foundations. In addition, it affords full vertical waterway clearance from pier to pier and is not unpleasing in appearance. These properties had considerable bearing on the selection of this type of structure for the Wilson River bridge. The writer ventures the prediction that this structural type will become more popular with American engineers as they investigate its possibilities.

British Standards for Cranes to Insure Greater Degree of Safety

The use of timber is prohibited in any stress-bearing part of new standards for derrick cranes, power-driven and hand-operated, and for traveling jib cranes (contractors' type), just announced by the British Engineering Standards Association, according to the *Commercial Standards Monthly*.

The object of these specifications is to secure the general observance of such fundamental principles as appear desirable to insure reliability and safety without hampering the freedom of the crane maker in his selection of the most appropriate design for the purpose in view.

The derrick-crane specifications provide for the Scotch derrick, the guy derrick and the tower derrick types of cranes, now largely used in building operations. The factors of safety and allowable working stresses specified are applicable to cranes intended for ordinary duty. Higher factors of safety and lower working stresses are recommended for duties of greater severity, or where there is a liability to accidental overloads, as in dock-side, quarrying and magnet cranes.

City Engineering Evolution During 30 Years

New services due to changed habits of living, and rising standards of public service, transform the work of the municipal engineer and forecast further change—Efficient executive coordination of specialist service is essential to modern city engineering

By ROBERT HOFFMANN
Consulting Engineer, Department of Public Service, Cleveland, Ohio

FOR MORE than three decades Robert Hoffmann has been identified with the city engineering service of Cleveland. In that city of rapid growth and high development he has had a peculiarly intimate view of the change from the old days of city engineering to its present highly specialized and ably organized state. No one can indicate more truly than he the line of advance along which the art is moving as a result of its progress since the opening of the century. Recently when he relinquished the position of chief engineer of the department of public service—Cleveland's title for the city engineer—and was promoted to consulting engineer of the department, we requested Mr. Hoffmann to set down a brief sketch of this progress. The present article is his response.
—EDITOR.

THIRTY YEARS' TIME in almost any period of modern history doubtless brought about marked and important changes. Probably in no period, however, have changes been more extreme and far reaching than in the field of science during the first 30 years of the present century. Changes and growth in municipalities, dependent as they are on the application of science, have kept pace with and have been affected by the latter's development. As a result the work of the city engineer has developed and changed accordingly, so that the magnitude and variety of his work, his status and the recognized importance of his functions, are quite different today from what they were 30 years ago. These differences were brought about not abruptly but so gradually and unobtrusively that it was impossible to recognize them as they were forming, thereby making it difficult to fix with any certainty the time when such change was initiated or to describe definitely their cause or effect.

I am here using the term "city engineer" to designate either an individual or a group of men, depending on the size of the city, and its organization, and on whether its engineering functions are centralized or are allocated to a number of heads.

Some Results of City Growth

During the three decades all cities grew continuously and rapidly. The increase in population and area brought new problems involving maintenance of health and provision for transportation. Sanitary measures as well as recreational facilities, not essential in small communities, became most necessary as congestion of population increased. Similarly, growth of city area separated by long distances the homes of its inhabitants from their places of work, requiring new and enlarged transportation facilities in order to reduce the time spent in transit.

In the earlier part of this period it was seen that the development of cities could no longer continue in haphazard manner but required intelligent planning and direction. Accordingly a well-defined city-planning movement developed, followed by the formation of city plan commissions. The city engineer largely aided this movement and frequently directed it. Methods and laws were established to control plotting of lands and laying out of streets, planning of parks and recreational facilities. Finally there came zoning, to direct the character of building and distribution of occupation. Supervision of architectural treatment of public structures developed with the growth of the city plan movement and was accompanied by greater responsibilities for the engineer in his consideration of the esthetics of his work.

New requirements and methods of transportation created an imperative demand for road construction, so that the amount of street paving laid far surpassed that of any previous period. From the viewpoint of both safety and convenience, road improvements came to be looked upon as a necessary adjunct of all desirable urban and suburban land developments. Heavier vehicle loads, together with a better knowledge of physical and climatic conditions affecting pavements, brought about more substantial and more serviceable construction. A large part of the city engineer's problems centered in pavements.

Domestic water supply and sewerage have grown greatly in importance, and under existing health regulations only effective systems for these services are now

tolerated. Sanitary science has developed to the stage where results not possible in former days are now attainable at reasonable cost, and modern facilities in this field are now looked upon as imperative necessities in every city. Today, therefore, an adequate and pure water supply, water filtration, stormwater and sanitary sewers, and proper installations for the treatment of sewage constitute major subjects for the engineer's attention.

With the passing years railway grade crossings became more and more of a menace and inconvenience as highway traffic increased. This condition brought about new activities for the city engineer, as he necessarily became one of the city's representatives in negotiations with the railroad companies to determine the type and plan of the improvement and the division of the cost. Incidentally, the negotiations between the engineering representatives of the railroad companies and those of the cities doubtless aided in establishing the better cooperative feeling between public-service corporations and cities that exists today, compared with that of 20 or 30 years ago. The engineering and technical questions involved would naturally be viewed from an engineering standpoint by the engineering representatives, making possible the proper solution of the problem without a spirit of barter and without taking unfair advantage.

Other services, formerly not required or else furnished through private agencies, are now looked upon as necessary public functions. Garbage collection and disposal, rubbish collection and destruction, supply of electric power and light are some of the undertakings falling in this classification. In the treatment of city wastes very distinct advances have been made in grease and fertilizer recovery and in the installation of rubbish incinerators, all requiring a high degree of engineering skill. Playgrounds, bath houses, swimming pools, boulevards and parks, at one time looked upon as more or less unnecessary refinements, are now considered essential to care for conditions brought on by congested population.

Special Problems of Transportation

Growth of vehicular traffic has been such that nearly all cities have been compelled to widen existing thoroughfares, open new streets and extend others. Often it has been necessary to buy extensive areas of land and destroy valuable buildings, to an extent unknown in former years, in order to meet the needs of traffic. This has cost both cities and benefited property owners large sums and has made heavy demand on the engineer in making surveys, preparing plans and working out data for establishinig an equitable division of the cost.

Transportation in general means thought and work for the city engineer. It involves street openings, pavements, bridges, grade separations, rapid-transit and street-railway subways, and the many underground improvement changes incidental thereto. At the present time even elevated sidewalks and two-level streets are being considered (and in the larger cities constructed) in an attempt to meet the urgent traffic demands. And, finally, water transportation adds to the city engineer's responsibilities. Wherever cities are located along navigable waters he must engage in dock and pier construction, dredging of channels, shore protection and other similar projects.

All these things have required large expenditures, the amount of which is now one of the outstanding features of public work and service, as compared with conditions 25 or 30 years ago. In appraising the meaning of the higher city costs, allowance must be made, of course, for increased living expense and the greater cost of both labor and material entering into construction and maintenance. Yet even after making such allowance it will be found that the more substantial character and greatly increased scope of present-day public improvements inevitably meant a constantly increasing expenditure, requiring great care and ability on the part of those directing the work to assure its efficiency, economy and soundness.

Financial Aspects of the Change

Using the experience of Cleveland as illustrative of that of nearly all large cities it is of interest to note the following:

During 1900 about 256,000 sq.yd. of paving was laid at a cost of $433,000. In 1925 1,086,600 sq.yd. was laid at a cost of $6,313,400. This means that in 1925 there was more than four times as much paving than in 1900, but at about fourteen times the cost. The difference in the average cost per square yard—namely, between $1.69 and $5.80—represents both the increase in unit costs and more substantial construction.

The water-supply investment was increased during this period between 1900 and 1930 by expenditures in excess of $40,000,000 in enlargements and extensions. During this period water filtration, an added service, was provided through the building of two filtration stations, each of about 150,000,000 gal. daily capacity.

Following an exhaustive investigation into known methods of sewage treatment through operation of a testing station, parts of three sewage-treatment works were constructed in conformity with a comprehensive plan for the treatment of all of the city sewage. A system of intercepting sewers was also built to collect sewage from various parts of the city and bring it to the treatment works for disposal.

Separation of grades of railroads and highways was begun about 1905 and has been in progress since. Seven railroads were involved in this work, and up to the present grade crossings at about 90 streets have been eliminated.

Public buildings were constructed, including a city hall, an auditorium, city hospitals and other welfare structures, and the large stadium that was only recently completed.

The City Plan Commission was established under a provision of the city charter and the building zone law was put into effect.

Opening of new streets and widening of existing ones have been consistently prosecuted at a cost of several million dollars for the city's contribution alone.

All this has been done with apparent general acclaim and desire.

Much Public Work Yet to Be Done

Whether this condition can continue depends almost wholly upon the taxpayers' ability and willingness to pay, both of which are somewhat strained at present. There can be no doubt, however, that an unlimited amount of public work still remains that could well be done in serving the convenience, health and necessities of the people. How rapidly this work is to be undertaken must, from the nature of things, be decided by the citizens, since they must pay the cost.

From the foregoing the importance of the city engineer in his relation to public welfare can be easily

understood. In view of the complexity and responsible nature of his functions, the necessity of his being properly educated and trained may be appreciated. In addition, he must have the proper personality if his work is to be successful.

Building on Experience

In what manner or extent is the status of the city engineer different today from what it was 25 or 30 years ago? It cannot be contended that the engineers of today have greater native ability. Those of the earlier date accomplished great things, often under heavy handicaps, and their work is used and admired even today; many of them, moreover, had relatively as good an education and training as the engineers of today, and in personality, which is not a matter of years, they were doubtless the equals of their present-day successors. Yet the status of the engineer has changed in conformity to the demands and responsibilities required by changing conditions.

The experience of a quarter of a century, coupled with extensive technical research, study, discussion and report, so admirably published and promulgated by the technical press and otherwise, has added largely to the store of knowledge and has assisted the engineer in keeping himself abreast of new needs. Thus he has been able to equip himself with capabilities not granted in any comparable degree to the engineer of 30 years ago. These experiences and developments have furnished the engineers knowledge that their predecessors could not possess, so that many projects can now be successfully carried on that were formerly impossible. Water and sewage treatment are representative of improved processes. The great advance made in equipment and construction machinery also operated as a powerful aid, without which much of the work of today would be practically and financially impossible—in city engineering quite as much as in other departments of the civil engineer's activity.

Political Influence Has Lessened

One vitally important change in city engineering must not be overlooked: the change in its relation to politics. Formerly nearly all engineering positions in the public employ were dependent in some measure on the organization or political party temporarily in possession of the appointing power. Usually the engineer held temporary employment subject to the whims or policy of a temporary executive. Under such conditions there was little incentive for him to work on policies or plans involving future development, and the result was that he largely restricted his attention to caring for immediate improvements. The city engineer devoted himself to routine grading, paving and sewer work, with an occasional bridge or other more or less unique structure that lent some variety to his work and injected a little life and pleasure into an otherwise drab existence. There seems to be less dependence today on political or party control temporarily in office, and the engineering department has a better background and is enabled to do its work without fear of unwarranted interference or domination.

I believe that this noteworthy change has partly come about through recognition of the fact that so large a part of the engineer's work is directly for the benefit of and in conformity with the wishes of the voting population. Astute party leaders see the wisdom of not disturbing engineering direction of work that must carry on and will not stop or necessarily be finished with the end of a political administration.

It is this direct contact that the work of the city engineer has with the general public that forms one of its distinguishing features. The work is nearly always helpful and constructive and seldom of a restrictive nature or contrary to the will of the people. The public is demanding so much greater service today than formerly that as a matter of course the engineer's work has grown in importance and magnitude, thereby making him to some extent at least the people's representative. There is scarcely a property owner who has not at some time found it necessary to deal with the city engineer's office in quest of information or advice.

Specialization and Coordination

The added functions herein referred to have broadened the work of the engineer and required increasing versatility and familiarity with many different branches. This is true in spite of the general tendency of the times to specialize. The engineer who is in an executive position in municipal work must have some knowledge of many different branches of engineering that in private practice would be largely directed by specialists.

Specialization, however, may be creeping into municipal work. Even today the work delegated to the city engineer varies in different cities, depending on the local organization and the policy of the administration, and may include all or only a part of the functions herein enumerated. Within the limits of the individual's capabilities to properly supervise it is probably better to maintain an executive engineering official to centralize under one direction as many of the functions as possible in order to secure better cooperation and establish a more logical progress of the work. It follows as a matter of necessity that the city engineer's department must be divided into a number of subdepartments in charge of capable assistants, upon whose ability the success of any engineering department largely depends.

The City Engineer's Work Well Done

In summary, the notable changes or differences in the city engineer's field within the last 30 years include: (1) increased demand upon the part of the public for many services not formerly required but now thought essential; (2) new need for facilities to provide properly for health and transportation in meeting a demand arising from congestion of population; (3) increased cost of public work due to higher wages, to more substantial construction and especially to large increase in volume; and (4) increased importance of the city engineer himself, due to his meeting enlarged responsibilities and accommodating himself to changing social and political conditions.

It seems, therefore, that as is the case in all other fields of human endeavor the field of the city engineer is affected and controlled by the many discoveries and advances made in the realm of science, as well as by changes and innovations that have modified and altered our social and political organization. These have been notably active during the last 30 years and have left their imprint on our methods of living. I strongly believe that the city engineer has played his part and been equal to the responsibilities with which he was confronted and that he is carrying on his work, now more than ever, with the thought in mind of making it a career rather than a temporary vocation.

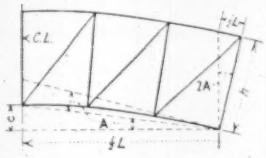
FROM JOB AND OFFICE

Hints That Cut Cost and Time for the Contractor and Engineer

Determining Height of Blocking for Short-Span Steel Trusses

By PAUL ANDERSEN
Designer of Bridges, Arkansas State Highway Department, Little Rock, Ark.

CAMBER for short-span steel trusses is usually introduced by lengthening the top chord and leaving all other members unchanged. For such structures the amount of blocking up necessary in erection can easily be computed by the simple formula $c = \frac{iL}{8h}$, in which c = camber, i = increase in length of top chord, L = distance between pins, and h = height of truss. In the derivation of this formula an additional symbol, A, is used to represent one-half the angle between the horizontal and the tangent to the bottom chord at its end.

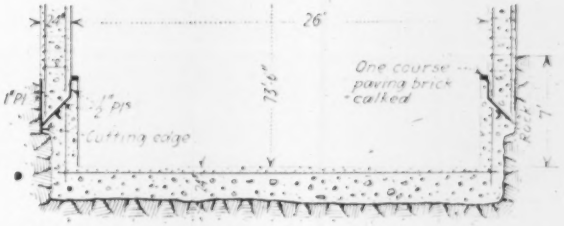


Half elevation of truss

Referring to the sketch, it will be seen by trigonometry that $\tan A = \frac{c}{1/2\,L}$ and $\tan 2A = \frac{1/2\,i}{h}$. For small values of A it can be assumed that $2 \tan A = \tan 2A$. Substituting of the values already given in the latter equation and transposition gives the formula for camber.

Testing Pit Sunk as Open Caisson

A WELL or machinery pit 26 ft. in diameter and 75½ ft. deep for testing purposes at the plant of the A. O. Smith Corp., Milwaukee, Wis., was constructed last year by sinking a concrete caisson by open excavation. Care was necessary because the pit location was near a large footing of a partly completed factory building. As the first step a pit 15 ft. deep, 32 ft. in diameter at the bottom and 44 ft. at the top was dug with a crane handling a ¾-yd. clamshell bucket. This was in soft clay, but at a depth of 15 ft. a thin vein of quicksand was encountered, which was controlled by marsh hay and clay packed behind plank sheeting. The steel cutting edge, assembled at the bottom of the pit, consisted of a 1-in. outer plate 3 ft. wide, rolled to a diameter of 30 ft. at the top and 30 ft. 4 in. at the bottom; a ½-in. inner plate 1 ft. wide rolled to 26 ft. diameter; a sloping plate welded to inner and outer plates; and ½-in. transverse diaphragms at 4 ft. spacing. As the 1-in. plate became slightly bent in sinking, by contact with stones and boulders, it is thought that a 1½-in. plate would have been better. The taper of the outer plate was intended to give clearance between the caisson and the earth. The concrete shell was built up in steel forms above this cutting edge, the shell being carried up progressively as excavation inside allowed the caisson to sink. It was reinforced horizontally and vertically and was made of

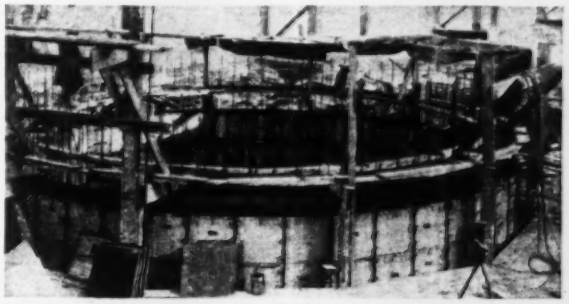


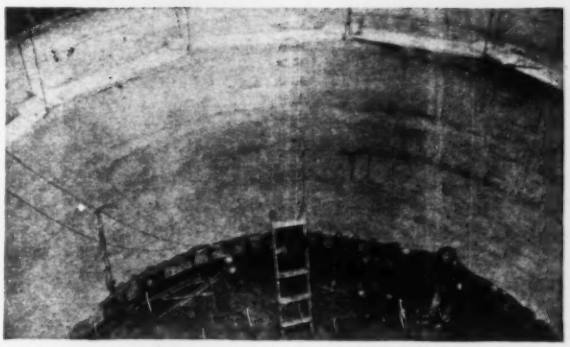
Caisson lining carried below cutting edge, as rock was encountered before reaching full depth

1:2:4 concrete, using high-early-strength cement, with 7 lb. of hydrate of lime per bag for greater density.

Excavation, after the first 15 ft. in soft clay, consisted mostly of blue clay and hardpan, with strata of soft clay and muck. Solid rock was encountered at 67 ft. Here a bench was leveled as a seat for the cutting edge. Excavation to 75½ ft. was continued through limestone bedrock. At the junction of the bottom lining with the cutting edge a course of paving brick was laid and calked against the steel to stop leakage at this point. Some leaks in the shell were patched by cutting out the concrete, roughing the surface and filling with rich grout or calking with lead wool. Sinking progressed at rates up to 10 ft. per day, with about 40 men, half working ten hours and half working fourteen hours. The spoil was excavated with pneumatic spades, shoveled into a clamshell bucket and dumped into a truck.

When the caisson was down about 45 ft. it was found




Top and interior views of concrete caisson sunk to form testing pit 26 ft. in diameter by 73½ ft. deep.

to be slightly out of plumb. Jacks and timber props took out some of the tilt, and when the cutting edge reached the rock 50 tons of steel was piled on one side of the caisson to bring it back completely, but without further recovery. As completed, the shaft is 8 in. off plumb.

The entire operation was carried on in winter, from Jan. 17 to March 3, 1930. As the building was not inclosed until Feb. 15, it was necessary to heat all aggregates and water for the concrete. Ed Steigerwald & Sons were the contractors, with Ed Steigerwald in active charge. The A. O. Smith Corp. was represented by E. W. Burgess, construction engineer, with Oliver Johnson as construction inspector.

Shielded Arc Process Used in Battledeck Floor Construction

A VARIATION of the usual method of battledeck steel floor construction was used on the new office building of the Pittsburgh-Des Moines Steel Co. at Des Moines, Iowa. This is a three-story structure 100x50 ft. The steel frame is of the traditional riveted construction, but the flooring is of the battledeck type. This flooring consists of $\frac{3}{16}$-in. structural-steel plates, 16 ft. 9 in. long and 48 in. wide, welded to 3-in. I-beams on 24$\frac{1}{8}$-in. centers, the latter being supported by the girders. On the job these plates were not squared or planed, but were used just as they came from the mill. Along the center of the plate there was a longitudinal row of $\frac{11}{16}$-in. holes on 12-in. centers, while the edges were similarly punched with half holes.

After the plates were placed in position on a floor, two of the full holes in the center plate were welded. The adjoining plates were then tack-welded in the same way, after which the center plate was fused to the three I-beams which it spanned. This procedure was followed on each floor, working from the center of the building outward. The welding was done with the shielded arc process. Each hole required less than 30 sec. of welding with $\frac{3}{16}$-in. electrodes. The heat at which this welding process is applied insures deep penetration. A 300-amp. welder supplied the current. A spacing of $\frac{1}{4}$ in. was allowed between the ends of the plates, which were fused into the supporting members with 2-in. stitch welds. Floor plates extend $2\frac{1}{2}$ in. into the exterior walls of the building.

Steel frame and floors of Des Moines office building

Photos courtesy Lincoln Electric Co.

Top and bottom of battledeck floor

Annealed plates were ordered so as to forestall buckling, although the structural engineers now believe that this precaution is not necessary. On the job a 400-lb. roller was rolled just behind the hole being welded and, as a further precaution, each weld was peened before rolling to counteract shrinkage strains. As a result of these precautions, only three of the 3-in. I-beams were buckled, and these so slightly that they were straightened by welding a bead below the flange. These buckles all occurred on the ground floor, which was the first to be constructed.

As the floors were laid before work was started on the masonry walls, it was not necessary for the masonry contractor to go to the expense of erecting scaffolding. A $\frac{1}{16}$-in. layer of mastic cement was poured on the steel plates, and the whole was covered with $\frac{3}{16}$-in. tile after the walls were completed. Plaster ceilings, fireproofing the steel and covering the conduits and piping, were suspended from the lower flanges of the I-beams.

The welding and steel erection was done by the owners of the building. Two welding operators were used. This type of flooring weighs 11 lb. per sq.ft.; concrete flooring of the same strength would weigh 33 lb. per sq.ft.

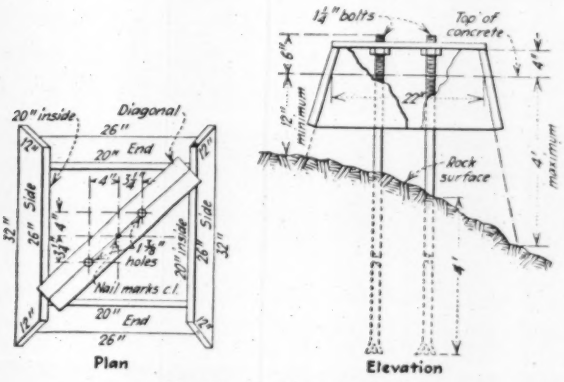
Templet for Transmission Tower Footings

By STUART L. MACDOUGALL
Hilton Beach, Ont.

FORMWORK for steel tower anchor-bolt footings in rock is costly, as many erectors of power transmission lines will testify. On the construction of the High Falls-Masson power line in Quebec for the James Maclaren Co., Ltd., a form-top templet was developed that greatly facilitated formwork over a considerable stretch of rocky right-of-way. The concrete footings were to be 22 in. square at the top and to taper 3 in. to the foot, with heights varying from a minimum of 12 in. to a maximum of 4 ft. Two 1$\frac{1}{4}$-in. anchor-bolts were to extend from 6 in. above the concrete to 4 ft. below, the lower sections being grouted into the rock.

The templet consisted of two sides and two ends, made of 1x12-in. lumber, and a 1x4-in. diagonal across the top. Details of construction are shown by the illustration. Side sections were extended 2 in. to permit field nailing of 2x2-in. corner members for extension downward.

After the anchor-bolts had set, the nuts were turned to proper elevation and the templet was slipped over the ends of the bolts with the diagonal resting on the nuts. Where extension to rock was required the 2x2-in. corner pieces were nailed on, and additional sheathing was added to fit the rock surface on all sides. The form was then ready to receive concrete, which was poured to a



Templet for tower footing

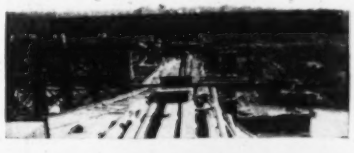
level 4 in. below the top of the templet, giving the required top dimensions of 22 in.

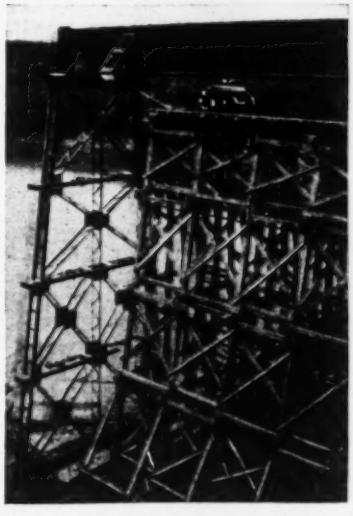
Heavy Girders Erected on High Dam

By J. C. LAMON
Phoenix Utility Co., Hot Springs, Ark.

DURING the construction of the Carpenter dam of the Arkansas Power & Light Co. on the Ouachita River in Arkansas it was necessary to erect a gantry crane at right angles to the dam crest and at an elevation 70 ft. above the base of the supporting A-frame. The largest pieces to be handled were two 126-ft. plate girders, each weighing 75 tons. No hoisting equipment was available which could lift these girders. They were to be unloaded from standard flat cars on the crest of the dam, swung through a 90 deg. angle and moved outward into position.

Turning the girders was done on the cars by placing under the exact center of each one a special bolster fitted with heavy iron circle plates 7 ft. in diameter. After the member was jacked up and carefully balanced it was slowly turned by a locomotive crane. To support it during the longitudinal movement a temporary wood trestle was erected at right angles to the unloading track. On this was built a standard-gage railroad track carrying two standard heavy steel-frame railroad trucks fitted with special bolsters to carry the girders into their final positions. After the operation was completed the trestle was removed.





75-ton girder after turning and longitudinal movements

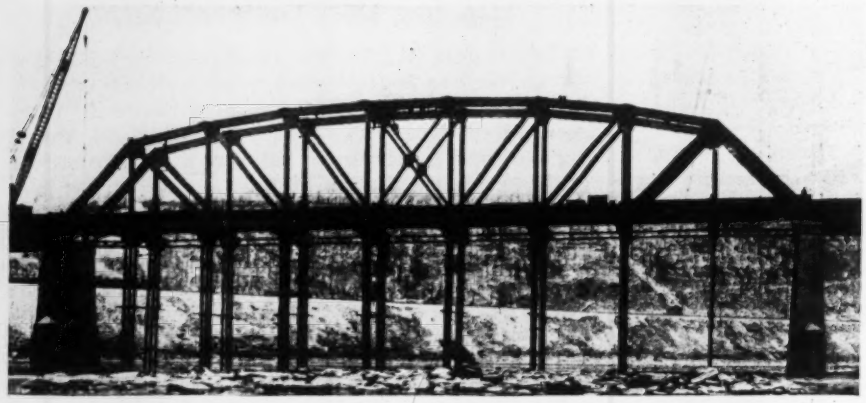
Handling Dock Gates in England

THE TROUBLESOME job of removing heavy dock and lock gates for repairs is accomplished either by flotation or by handling with cranes at the South Wales docks of the Great Western Railway, England, according to a paper by Hector G. Lakeman in the *Proceedings* of the Permanent Way Institution. For the smaller gates a pontoon is sometimes attached at low water, and, as the tide rises, the anchorages are disconnected and the gate is floated out. Another method is to erect from the dock wall a cantilever beam or "cathead" with suspension tackle, which is attached to the gate while the lock is full of water. As the water is let out, the gate is gradually lowered by the tackle until it rests in a horizontal position on a raft, which is then towed away.

For the larger deep-sea entrance gates weighing from 200 to 280 tons each a 125-ton floating crane is employed, the buoyancy of the gate being utilized to assist the operation. This crane has two sets of lifting tackle of 50 tons capacity, and a third of 25 tons, giving a total lifting capacity of 125 tons. It saves much time and labor in the removal and replacing of such gates and reduces the danger of a gate falling in the lock chamber, an accident that might cause serious delay to ships wishing to enter or leave the dock. In these heavy steel gates the interior is divided by a horizontal watertight deck or diaphragm forming a lower air chamber and an upper ballast chamber. Water has access to the latter when it rises above the level of the diaphragm, and thus prevents an excess of buoyancy, which would put a heavy strain on the anchorages holding the heel post in position. To prepare for removing the gate the purposes of these chambers are reversed, the inlets or scupper holes of the upper or ballast chamber being closed to convert it into a buoyancy chamber, while a calculated amount of water is placed in the lower or air chamber as ballast to give the gate sufficient stability. At low water the gate anchorages and all hydraulic connections are disconnected, and the gate is held in position by wire ropes and tackle. The water rises gradually until the gate becomes buoyant and is easily pulled out of its recess in the dock wall, after which it is lowered gradually by the tackle to a horizontal position and then removed to a drydock. If the 125-ton crane is used, a larger amount of water ballast may be placed in the air chamber.

Unbraced Steel Pile Bents Used to Erect Railway Truss

THE STEEL-TRUSS bridge over the Youghiogheny River at Connellsville, Pa., which forms the final link in the new line of the Pittsburgh & West Virginia Railway out of Pittsburgh, was erected on a unique falsework consisting of single-pile steel bents. According to James L. de Vou, division erecting manager of the American Bridge Co., who had charge of the work, the steel falsework demonstrated a superiority over timber falsework for this structure. It was necessary to drive the falsework through about 6 ft. of rock and boulders to a bed of rock lying beneath the bed of river. The driving was easily accomplished with the steel I-sections. It was also possible to erect the steel falsework in about one-third the time that would have been required for timber falsework, and it was felt that it was much more secure against the flood, ice and drift that characterized the river at the time the bridge was being



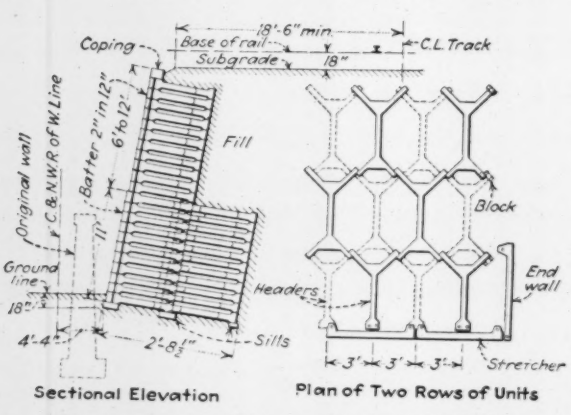
Unbraced steel pile bents used as falsework on P.&W.V. Railway bridge

erected. The falsework is about 70 ft. high above the river and requires no crossbracing between the bents. The truss has a span of 300 ft. and is part of a long viaduct.

Precast Concrete Cribbing for Retaining Walls

IN WIDENING the Chicago & Northwestern Railway for additional tracks at its new express terminal in Chicago (see *ENR*, May 14, 1931, p. 802), concrete crib walls were used in some places to retain the widened fill at the property line. The purpose of this construction was to expedite the work and to avoid the cost of monolithic-concrete retaining walls, which would have been much more expensive, besides requiring heavy pile foundations, while the cribbing is founded simply on a 10-in. bed of gravel, the soil being excavated about 18 in. below the surface to insure solid ground. Adjacent to a building, however, the excavation was carried down about 5 ft. in order to put the cribbing below the basement floor and so avoid pressure on the basement wall. Another advantage of the crib construction was that the fill could be placed and used at once, while a concrete wall would have required time for setting. However, monolithic walls were used where the height exceeded 25 ft.

• These crib walls consist of two or three rows of cribbing built up of precast units or beams, which break joints in alternate courses and are fastened together by steel dowels. With two or more rows, for walls more than 12 ft. high, they are interlocked and anchored together as shown. The 6-ft. stretchers in the front of the cribbing form a solid face or wall, with a batter of 2 in. to the foot. The headers, embedded in the fill, are about 6 ft. long. These members, weighing 300 to 350 lb. each, were placed by a locomotive crane. Filling was placed as the cribs were built up, the cribbing being not more than two or three courses above the filling. This material was gravel with a small amount of clay as a binder. It was placed in layers 8 to 12 in. thick and was well tamped under the crib members so that they were embedded in a solid fill.



Concrete crib wall, Chicago & Northwestern Railway

The contractor was the M. E. White Co., Chicago. The work was designed and carried out under the direction of Chester T. Dike, chief engineer, Chicago & Northwestern Railway, and O. F. Dalstrom, bridge engineer.

Letters to the Editor

Data Wanted on High Earth and Rock Fills

Sir—I would be greatly obliged if you could obtain for me any data on the highest fills of earth and rock that have been built for railroad work; also data on settlements observed in rock fills of great height (more than 100 ft.).

I would like to know whether it is for reasons of economy that the height of rock fills is limited to 200 or 300 ft. (as at Salt Springs Dam, for instance); or whether shortage of time or fear of settlements and slides are the chief reasons. What accidents have occurred on such fills, and have their causes been investigated?

FERNANDO G. ARENAL,
Ingeniero de Caminos.

Madrid, Spain,
July 27, 1931.

Cracks and Joints in Concrete Pavement

Sir—On pp. 50 and 53 of the July 9, 1931, issue of *Engineering News-Record* there is an article by Clifford Older on "Crack Occurrence and Control in Concrete Pavement," and also an article on "Tests of Load Transmission Across Joints in Concrete Pavement" by Searcy B. Slack, bridge engineer of the Georgia division of highways. Both of these subjects have engaged the attention of the California division of highways in the past, and our experience may be of interest.

In 1925 we constructed a section of highway in southern California, east of the city of Oxnard, some 4 miles in length, in which we used 38 different variations in construction. The purpose of this road, which was regular contract construction, was to determine the effect of the spacing of contraction joints on the cracking of pavement, and also to demonstrate to a certain extent the efficiency of our reinforcing and doweling system. Yearly observations are made on this section of pavement, and up to the present time we have found that the 20-ft. panel gives us the greatest freedom from transverse cracking, there being but six cracks out of 744 panels in the five years that have elapsed since the construction of the pavement. Due to a continually damp subgrade (the ground level is only slightly above tidewater) the base of the concrete has been continually damp and has resulted in a cupping of the slabs, which is quite noticeable

in certain locations. The maximum variation from a true line between the ends of the slab and the center is as much as ½ in., but in general it is considerably less than this.

As to the efficiency of dowel joints in which a ½-in. expansion strip is used, we have used this as construction for the last several years on probably 200 or 300 miles of concrete pavement from 6 to 9 in. in center thickness, and we have not had more than five or six failures of the dowels to carry the load across the joint. On one job, in which the expansion joints were not exactly vertical to the plane of the surface, there was in the case of four or five joints a breaking out of the dowels due to temperature expansion, but otherwise the results have been entirely satisfactory.

In a recent test made by our laboratory we found that dowels such as we use will stand a load applied at the edge of the slab of approximately 8,000 lb. before they will break out.

C. S. POPE,
Construction Engineer,
California Division of Highways.

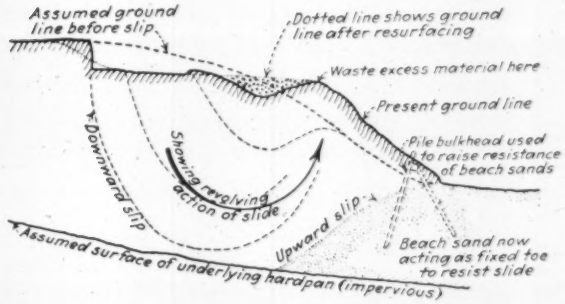
Sacramento, Calif.,
July 25, 1931.

Olympic Club Landslide, California

Sir—I was much interested in the discussions by Professor Terzaghi and Professor Krynine in *Engineering News-Record*, July 16, 1931, pp. 90 and 93.

I believe Professor Terzaghi has misapplied the word "erosion" to the sliding movement on an inner surface. The geological definition of the word erosion, from Funk & Wagnalls' latest dictionary, is: "the wearing away of rocks, chiefly by running water, but also by shore waves, glaciers and winds." Erosion is usually applied to influences of the sea along shore lines or rivers influencing the control banks, or rainfalls permeating soft-surface materials that are eroded from high elevations down to a lower one.

An interesting exhibit of undersurface movements in shown in the accompanying sketch and photograph of the Olympic Club grounds fronting the Pacific Ocean 1 mile south of San Francisco's county line. The great San Andreas fault line is immediately at the base of the slope at the ocean. An attempt was made some years ago to correct the unbalanced pressure of the moving hillside by accumulating beach gravel along the ocean shore. This was to be accomplished by means of building jetties at right angles to the shore. Jetties, instead of proving palliative, acted as a counter-irritant and deepened the water several feet, thereby provoking the action of the interior slides. The strange thing about those slides is that they take a rotary shape like an egg revolving on its curved base.


Assumed ground line before slip
Dotted line shows ground line after resurfacing
Waste excess material here
Present ground line
Pile bulkhead used to raise resistance of beach sands
Downward slip
Showing revolving action of slide
Upward slip
Beach sand now acting as fixed toe to resist slide
Assumed surface of underlying hardpan (impervious)

Section showing earth movement

There is evidence of ancient action of slides in this region. A recent movement was stimulated by irrigation water used on the golf ground, and a section of the soil revolved, so that the golf links had to be abandoned.

M. M. O'SHAUGHNESSY,
City Engineer.

San Francisco, Calif.,
July 22, 1931.

Distance Saved by the Dotsero Cutoff

Sir—Having read with interest your lucid article on the history of the Dotsero cutoff and the Moffat Tunnel, appearing in your Aug. 6 issue, I desire to point out a misstatement in the last paragraph thereof with respect to the distance saved by the cutoff.

You say: "The Dotsero cutoff will shorten the D.&R.G.W. route to Salt Lake by about 135 miles, or to 610 miles." As a matter of fact, the cutoff will shorten the route by 173 miles, making the distance between Denver and Salt Lake City 572 miles rather than 610 miles as you state. This distance is made up of the following mileages:

Denver to Orestod via D.&S.L. (using Moffat Tunnel)	128.55
Dotsero cutoff (Orestod to Dotsero)	41.30
Dotsero to Salt Lake City via D.&R.G.W.	402.44
Total, Denver to Salt Lake City	572.29
Present D.&R.G.W. route via Pueblo	745.10
Saving	172.81

In the last paragraph of the article other distances are given which also warrant comment. The statement is made that "The D.&S.L., as originally projected, would have given a 565-mile line between Denver and Salt Lake City, as compared with 620 miles by way of the Union Pacific at Cheyenne and 745 miles by way of the D.&R.G.W. through Pueblo." The 565 miles was a very approximate distance obtained from a reconnaissance survey of the old Denver Northwestern Pacific following a route over the Wasatch range that many believed impracticable.

In 1925 the Salt Lake & Denver Railroad sought permission of the Interstate Commerce Commission to build a connection with the Denver & Salt Lake Railroad from Craig to Springville on a surveyed route that would have made the distance, via D.&S.L.-S.L.&D., 578 miles from Denver to Salt Lake. This would compare with 614 miles via Union Pacific (present line) and 745 miles via D.&R.G.W., whereas the proposed route via D.&S.L.-cutoff-D.&R.G.W. will be 572 miles, or the shortest of any feasible route constructed or proposed.

C. M. LIGHTBURN,
Valuation Engineer,
D.&R.G.W. Railroad Co.

Denver, Colo.,
Aug. 12, 1931.

General view of Olympic Club landslide

NEWS OF THE WEEK

To Review Minneapolis Water System

Following much controversy in the Minneapolis city council over new pipe lines and extensions of the waterworks system, a commission of three consulting engineers, Prof. Frederic Bass, Adolph Meyer and Sven Norling, has been appointed to make a complete investigation and critical review of every phase of the waterworks system, including physical, financial and operation, to ascertain what essential extensions, improvements in the physical plant, changes in the methods of operations or financing are required. It is expected that the survey will require three or four months.

Chicago City Engineer Demoted

On the ground that an irregular examination by the civil service commission of the previous (Thompson) administration in 1929 was the basis of the promotion of Loran D. Gayton from engineer of waterworks design to city engineer, Chicago's civil service commission has ordered him returned to his former position. After the death of John Ericson an examination was held for the position of city engineer, and was taken by Myron B. Reynolds, assistant city engineer, and Mr. Gayton. It is now stated that the latter was not eligible, since the examination was open properly only to civil service employees in the next grade below city engineer. Mr. Reynolds retained his position and became acting city engineer in March, 1931, when Mr. Gayton was suspended by order of Mayor Cermak.

Work to Start Soon on Princeton's Community Center

Plans have been approved for the street layout for the community center of Princeton, N. J., and the plans for the post office, the first building to be erected there, have been drafted. The community center will cover four blocks and will replace some of the town's oldest buildings. The middle will be a plaza, and facing on Nassau St. will be a small park. The project is expected to cost $5,000,000.

Work on the post office will be started soon, and is expected to be finished within two years. Work on the Borough Hall and Nassau Tavern will then begin.

The project was started by the Princeton Municipal Improvement, Inc., a group of residents of the town, who are financing the improvement with the exception of the post office and the borough hall, which will be paid for by the United States and the town, respectively.

Official Report of Cause and Progress Hoover Dam Strike

A SUMMARY of the causes and progress of the strike on the Six Companies' operations at Hoover Dam has been made by John C. Page, acting construction engineer, to the chief engineer. The essential features of this report are given herewith.

In establishing a wage scale for work on Hoover Dam, the Six Companies set the minimum wage at $4. When the construction of headings for the diversion tunnels was started, hand muckers were employed temporarily at $5 per day. During the two weeks ended with Aug. 7 mucking machines were installed, and on that day at noon a notice was posted that the men who had been hand mucking would be transferred to other work at the $4 rate. This order affected about 40 men, according to the statement of company officials.

On the same day the swing shift on the tunnels did not go to work. During the night this shift was able to persuade the other miners to walk out and by morning all work centering at the river camp was shut down. The crew from there went to Boulder City and prevented the trucks from leaving Boulder City with the workmen on the tunnel outlets and other work being conducted from the Boulder City camp. Carpenters to the number of about 200 were required to leave the buildings and the mechanics were driven from the shops.

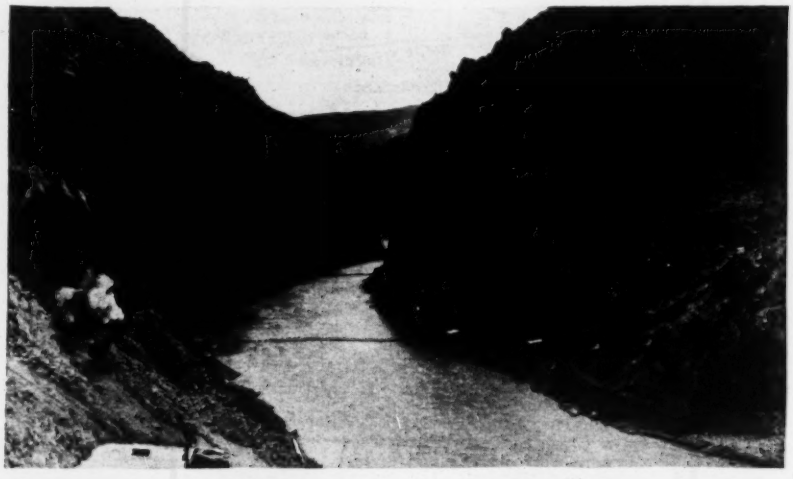
(Continued on page 349)

All-American Canal Water Users Agree on Allocation

An agreement concerning the allocation of the water has been reached among the various users of the water to be sent through the All-American Canal, authorized for construction in the Imperial Valley, California, under the Boulder Canyon project act, and these users are now ready to contract with the government for repayment of the cost of the canal, it is announced in Washington by the department of the interior. Representatives of the water users have been asked to meet officials in Washington during the week of Sept. 7 to work out details of the contract to be submitted to the secretary of the interior for his approval. Definite plans for the canal have not yet been decided upon, but the following is an outline of the project now being considered.

Of the $165,000,000 to be spent on the Boulder Canyon project, $38,500,000 is allotted to the canal, which will connect the Colorado River and the Imperial and Coachella valleys of California. The Coachella branch, however, was not included in the authorized appropriation for the Boulder Canyon project. It is estimated that the extension would cost $11,000,000. The cost of the canals and appurtenant structures is returnable by the irrigation districts in the valley, as provided in the reclamation law.

The diversion dam on the Colorado River will be located about 5 miles above the Laguna dam of the Yuma irrigation project. It will be of the floating or Indian weir type with a 1,700-ft. crest. About 16 miles west of Pilot



WORK UNDER WAY IN BLACK CANYON

Preliminary work for Hoover Dam down in the canyon of the Colorado River is well under way. This picture, taken recently, shows the first drifts for the diversion tunnels, the approach roads and the footbridges swung across the river.

Knob the Coachella branch canal will take out of the All-American Canal and run in northwesterly direction across the east mesa.

The canal will be about 200 ft. in width at the water surface, 134 ft. wide at the bottom and 22 ft. deep. It will be 75 miles long, with 115 miles set as the length of the Coachella branch. A diversion capacity of 15,000 sec.-ft. is planned, 2,000 of which will go to the Yuma project.

It is estimated that 60,000,000 to 65,000,000 cu.yd. of excavation will be required, of which 4 per cent is rock. The canal for 10 miles will pass through a ridge of shifting sands, where the deepest cut will be 100 to 120 ft. Growing vegetation in a zone on each side of the canal is one means under consideration to prevent sand from drifting into the canal.

At several places along the canal, it is estimated, power can be developed with a total of 60,000 kw.

Cleveland Engineers Report on Alternate Bridge Approaches

At the request of the commissioners of Cuyahoga County a committee of engineers chosen from the regional planning division of the Cleveland Engineering Society recently submitted a report on the relative merits of two alternate approaches to the proposed Main Ave. high level bridge over the Cuyahoga River. The recommendation was made only after careful study of all possible considerations affecting the two proposed routes and after hearing testimony presented by engineers and others officially interested in the project. The committee consisted of C. W. Courtney, chairman of the regional planning division of the society, who also acted as chairman of the committee; William J. Carter, of Carter-Richards Co., consulting engineers; Wendell P. Brown, consulting bridge engineer; E. A. Fisher, city engineer of Lakewood; and Charles W. Root, engineer.

Immediately upon receiving the report the county commissioners not only passed a resolution thanking the society for its work, but also requested it to present a bill for services rendered. This the society declined to do, on the ground that the original understanding had been that the report should be rendered as a gratuitous public service.

Proposal to Abandon Patent Paving in Los Angeles

The Los Angeles board of public works is seeking to ban the use of patent paving on the streets of the city. The board has passed a resolution rescinding the license agreements of six patent paving firms, to be effective six months after the city council and the mayor approve the resolution. The resolution contains the following statement: "It is the opinion of the board that none of the patented pavements mentioned is better than unpatented pavements."

Hoover Dam Strike

(Continued from page 348)

Two trucks under Superintendent Cairns escaped molestation and went to work on Saturday morning. At noon orders were given to discontinue work rather than to continue the agitation, thus suspending the entire operations of the Six Companies.

Demands of the Strikers

A committee of the workers requested an interview with the officials of the Six Companies on Aug. 8. At that time they presented in writing their demands as follows:

1. We ask that the company continue to carry on as rapidly as possible and better living conditions.
2. We ask for iced or cold water on the job until Frigidaires are installed, because we have suffered from the warm water and lack of water at several times.
3. Anderson has been charging $2 per day board for those on the graveyard shifts. We ask a flat rate of $1.50.
4. We want eight hours, camp to camp, or as near as we can get. We are willing to split—one way on company's time, one way on our own.
5. We want strict enforcement of Arizona and Nevada state safety laws; a safety inspector or miner in every heading.
6. We ask that no employee who is in this meeting will be discharged, but that all will be allowed to return to work.

Reply of the Contractor

The committee was informed that 24 hours were required to consider their demands and that they would receive their answer on Aug. 9. At that time Frank T. Crowe, general superintendent of construction, made the following statement:

This is to notify all Hoover Dam employees that the job is closed down until further notice.

The mess house will be closed tonight to everyone except office help and "bull" cooks and watchmen.

Trucks are available for transportation to town. Pay checks are ready for issue upon the usual checking out with the "bull" cooks.

Early in the week all but about 200 of the men had accepted their wages and left the reservation. This group of 200 established themselves on the reservation with the apparent determination of sticking it out indefinitely. On Aug. 11 the construction engineer issued an order to the strikers to vacate the reservation. This was accomplished in an orderly manner, and the strikers established another camp outside the reservation on the road to Boulder City at a point about 8 miles from Las Vegas. In the meantime the federal government assumed jurisdiction in the reservation and the United States marshal took charge to prevent possible disorder.

United States Hiring Workers

On Aug. 13 the construction engineer issued an order to Six Companies, Inc., to resume work on its contract. The United States labor commissioner established an office at the main entrance to the reservation and immediately began hiring men for all contractors within the reservation. Six Companies, Inc., announced that no new men would be hired until all worthy former employees had been given an opportunity to go back to work. This policy is being rigidly adhered to and at present about 1,100 men are back on the job.

A small group of strikers has established pickets at advantageous points warning men that a strike is in effect and to stay away. No violence of any kind has occurred nor has any been attempted, and it is expected that the strike will gradually wear itself out.

Hoover Dam Notes

Because of the strike very little work was accomplished by the Six Companies, Inc., during the week ended Aug. 15. Other contractors carried on. Bowers & Dickerson continued work on a group of twelve residences. The Wheelwright Construction Co. completed laying pipe to the receiving tank of the water system and now is backfilling on the line. The Pacific Steel Co. has completed its contract with the exception of painting and calking the sump tank on pumping plant No. 1. The New Mexico Construction Co. has excavated 2,765 ft. of trench for the outfall sewer. Pipe laying began during the week.

Government forces have completed the installation of the equipment for the clarifier tank for the water system. Pipe and connections for pumping plant No. 1 are practically complete.

The contract for the erection of the administration, dormitory and municipal buildings was awarded to B. O. Siegfus, of Salt Lake City.

Plans Ready for Third Unit of San Francisquito Power Plant

Completion of plans and specifications for the third unit of Power Plant No. 2 in San Francisquito Canyon has been announced to the Los Angeles board of water and power commissioners by H. A. Van Norman, general manager and chief engineer of the department of water and power.

Specifications for the additional steel penstock will be ready in a few days, Mr. Van Norman said. The addition of the third unit will provide 18,000 hp. of generation capacity to the more than 40,000 hp. now operating in the plant, it was pointed out.

Provision for these additions was made in the 1931-32 electric system budget of the department of water and power. The cost of the betterments is estimated at $1,000,000.

New Regulations to Govern Ontario Architects

An order in council has been passed by the Ontario government by which architects are prevented from accepting remuneration for work performed by them from any source other than from the client for whom the service is rendered. Commissions from contractors may not be paid to architects. An architect must not accept work that has already been touched by another architect without first advising him.

Cleveland Public Improvement Bonds Ordered Sold

Continued execution of Cleveland's extensive program of public improvements was assured by the action of the city council on Aug. 21 in authorizing the sale of $6,100,000 of the bonds approved by the voters last November. Of that amount $5,500,000 is to be used for construction work: $4,000,000 for the Easterly sewage-treatment plant, $1,000,000 for main sewers, and $500,000 for an exposition hall to be built under the wide mall between the city hall and the municipal auditorium.

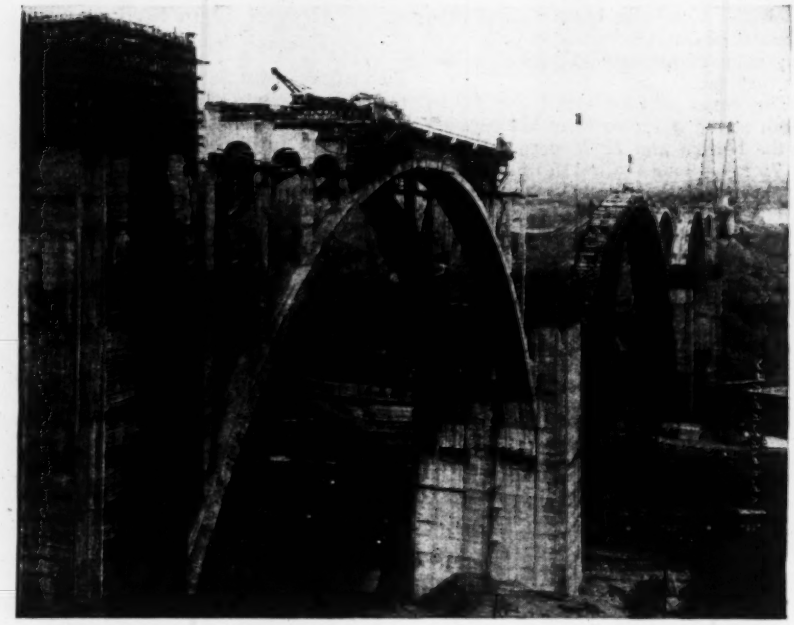
The $4,000,000 authorized for expenditure on the sewage-disposal program is the second item to be approved by the council of the $14,000,000 estimated for the total project. An item of $1,000,000 was authorized some months ago and is now being used for the construction of a breakwater at the plant site, for which the contract was let on Aug. 5, and for engineering expenses.

The cost of constructing the underground exhibit hall is estimated at $1,000,000. The first $500,000 of this amount was authorized for expenditure some time ago and the present action of the council makes the total amount available.

The complete program of sewer construction involves the expenditure of $5,000,000.

The new Easterly plant, now being designed by George B. Gascoigne, consulting engineer, will have a capacity of 123 m.g.d., providing for a population of 770,000. Activated sludge treatment will be employed, with grit chambers, presettling tanks, aeration tanks and final settling tanks. Because of the limitations of space and the character of the surrounding neighborhood, excess sludge will be piped 12 miles to the Southerly sewage plant, where digestion tanks will be built.

Issuance of bonds to the extent of $1,500,000 to start the plan of straightening the Cuyahoga River will be delayed for a year. River improvement has been held up by a taxpayer's suit.



GEORGE WESTINGHOUSE BRIDGE AT PITTSBURGH TAKES SHAPE

Concrete is being poured at the present time in the downstream rib of the 460-ft. main span of the great bridge over Turtle Creek Valley in East Pittsburgh; the view shows work on the upstream rib with all of the side span ribs completed. Arch centering used on the relatively short side spans (295 ft.) has been adapted to use on the main span by the use of two intermediate towers. The main span is the longest concrete arch in America. The bridge is being built for the Allegheny department of public works by Booth & Flinn.

Committee Recommends Private Design of Public Buildings

In view of the desirability of prompt action in getting government building work under way, and in view of alleged inability of the office of the supervisory architect of the U. S. Treasury to handle this work expeditiously, a committee of the Minnesota Federation of Architectural and Engineering Societies has made a report urging the government to extend the practice of utilizing the service of engineers and architects in private practice to design public buildings and other structures. In such case the government departments would undertake approval of the plans or designs and supervision of the construction. It is pointed out that although the supervising architect's office is unable to handle the great amount of work expeditiously, only a few of the many projects have been assigned to architects and engineers in private practice. It is argued that concentration of such designing at Washington tends to discourage individual initiative and to check progress. Furthermore, since the rapid prosecution of work on these structures is intended to relieve the unemployment situation, it is desirable that there should be increased employment for engineers and architects as well as for contractors and workmen.

Board Proposed to Coordinate Transport Control

The formation of a board to coordinate the activities of the various transportation-regulating agencies of the government is proposed by Thomas H. MacDonald, chief of the Bureau of Public Roads. This board would be composed of representatives of the aeronautics branch of the commerce department, the Interstate Commerce Commission, the Bureau of Public Roads and the Inland Waterways Corporation. Mr. MacDonald believes that such a board would promote the economic and beneficial utilization of all of the various forms of transportation without interfering with the particular function of any other regulating agencies.

In dealing with the question of providing suitable regulation for interstate buses, Mr. MacDonald believes that such a board would be particularly effective. Apprehension has been expressed by some bus operators that the Interstate Commerce Commission, if vested with authority to regulate buses, would be primarily concerned with extending its regulation so as to reduce bus competition with railroads. On the other hand, a board on which highway engineers are represented would be more apt to regulate buses in consideration of the part they play in the nation's transportation scheme instead of in the interest of a competing industry, it is contended.

As a result of the failure in Congress last session of the Parker interstate bus bill there is some feeling in the bus industry that further legislative attempts should seek a regulatory agency other than the Interstate Commerce Commission.

Coast Utilities Consolidate Engineering Departments

Consolidation of the engineering departments of Pacific Power & Light Co. and Northwestern Electric Co., Portland, Ore., and their subsidiaries, under H. H. Schoolfield as chief engineer, and the purchasing departments of the Pacific and Northwestern companies and Portland Gas & Coke Co. under A. W. Angell as purchasing agent, was effected early in August. The three companies are operating properties of American Power & Light Co.

COSTS AND CONTRACTS

ENR Index Numbers

Cost			Volume		
Aug. 1,	1931	168.38	July,	1931	277
July 1,	1931	174.37	June,	1931	243
Aug. 1,	1930	200.95	July,	1930	226
Average,	1930	202.85	Average,	1930	260
Average,	1929	207.02	Average,	1929	317
1913	.....	100.00	1913	.....	100

This Week's Contracts

Heavy construction contracts, reported by *Engineering News-Record* in the week of Aug. 27, with some comparisons, total as follows:

(In Thousands of Dollars)

Buildings:	Aug. 27, 1931	Average of Last Four Weeks 1931	1930
Industrial	$3,665	$2,950	$4,477
Other	7,193	12,990	24,667
Streets and roads.	2,899	7,777	12,254
Other construction.	9,826	13,621	18,499
Total	$23,583	$37,338	$59,898

Total, all classes, Jan. 1 to Aug. 28:

1931	$1,788,611
1930	2,353,972

Contract for 110-Mile Railroad in Texas

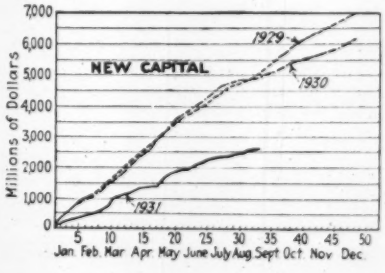
The Fort Worth & Denver Northern, a subsidiary of the Colorado & Southern Ry. (Burlington System), has awarded the contract for its 110-mile line between Childress and Pampa, Tex., to Hamilton & Gleason, of Denver, Colo., and Roberts Brothers, of Chicago. This work is under the direction of R. C. Gowdy, chief engineer of the Colorado & Southern, Denver, Colo.

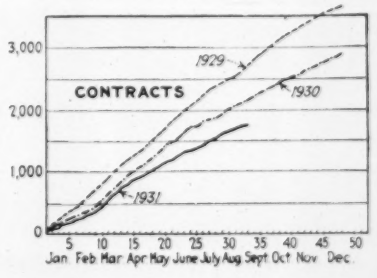
Capital and Contracts

Last week's total of new capital issues was the smallest offered in any week since that of Nov. 1, 1929, immediately following the stock-market crash. While the total was unusually low, seasonal dullness is to be expected in the bond market at the conclusion of the summer season.

The four issues, which aggregated about 7 millions, were as follows: Houston Lighting & Power Co. 4½s, $5,000,000; Bloomfield, N. J., 4½s, $743,000, school and improvements; Irvington, N. J., 4½s, $503,000, sewer, and $585,000, improvements.

Cumulatively, the total issued from Jan. 1 to Aug. 22 reached 2,579 millions, compared with 4,839 millions for the corresponding period of 1930.





WASHINGTON NOTES

By PAUL WOOTON
Washington Correspondent

No General Use of Federal Funds to Be Made for Unemployment Relief, Washington Announces

EVERY effort will be made by the administration to prevent any general use of federal funds for local relief. Certain exceptions will be specified to meet a few unusual cases, but the amount of federal money necessary to meet those situations will not be large. It is believed that the states are amply able to provide whatever may be needed in the way of food, clothing and shelter. The principal danger in the present situation, some feel, is that the advocates of direct relief will convey the impression that the federal government will take care of the situation, thereby removing the principal stimulus behind local effort.

Statements to the effect that planning for next winter began only recently are strongly resented in administration quarters. It is declared most positively that planning for the coming winter began before the last winter was half gone and has been continued in an intensive way each day since.

The President's Committee on Employment is now compiling statements from 25,000 local organizations as to the probable needs next winter of their communities. Steps are being taken to insure the selection of competent local leaders and they are being told of experience elsewhere that may be valuable to them in securing funds from local public and private sources.

Cooperation With Industries

The President's committee has been cooperating actively with industrial concerns. This has resulted in spreading out the work among all employees and in utilizing their services in beautification around plants and such jobs as could be created to keep them employed when the plant itself had to be closed. Communities have been stimulated to clean up along railroad tracks and to ask owners of private properties along railroads and main highways to paint up and clean up.

While principal emphasis is now being given to the creation of employment along lines other than the public works program, this continues to be the backlog of reliance, as there are pending no less than $6,000,000,000 worth of such projects. It already has been announced that there will be no curtailment of the federal public works program, but it is recognized that many state, county and municipal projects are likely to be delayed because of the difficulty of financing them at this time.

One of the strong possibilities of the federal program is another emergency appropriation for highway construction. Highway construction proved to be a most effective aid during 1931. In view of the success of the program this year, it is believed that larger federal appropriations will be made in 1932.

Construction work on federal buildings will absorb 80,000 to 100,000 additional workers before Jan. 1, President Hoover announces. On Aug. 1 the program was providing work for 730,000 men. Before construction was speeded up to provide additional employment, the total number engaged was 180,000.

New Building for Timber Study

Under an appropriation of $900,000 by Congress for the Forest Products Laboratory, contracts have been let for a new building and plant at Madison, Wis. The main structure, 275 ft. long and six stories high, with 175,000 sq.ft. of floor space, will include a pulp and paper research department, dry kilns, cold rooms for keeping logs and timber in uniform condition, a woodworking shop and facilities for experimental work in wood chemistry, timber preservation and other activities. Testing machines of 1,000,000-lb. capacity will be served by cranes on a gallery which will accommodate pieces or panels as large as 100 ft. long and 30 ft. high. There will be a 630-hp. power plant, supplying steam, water, gas, electricity and compressed air. Holabird & Root, Chicago, are the architects, and the contract has been let to C. B. Fritz & Co., Madison, Wis. A 10-acre site was donated by the University of Wisconsin.

The Business Outlook

The mixed character of business news leaves the general situation practically unchanged. Renewed efforts of the Federal Reserve to expand credit outstanding, a slight improvement in July imports, the stability of last month's wholesale prices, the remarkable increase in the domestic consumption of electricity and favorable reports from the shoe, leather and textile industries contrast with reports of further bank failures, an excessive volume of currency circulation, a sharp decrease in the industrial consumption of electricity, falling payrolls and employment, declining building operations and unfavorable carloading trends.

—The Business Week, Aug. 26.

Personal Notes

DONALD C. MACMILLAN, city engineer and superintendent of streets for Ventura, Calif., has resigned, effective Oct. 1.

HERBERT J. GILKEY, formerly professor of civil engineering, University of Colorado, has been appointed head of the department of theoretical and applied mechanics at Iowa State College, Ames, Iowa.

THOMAS LEAHY, of Denver, Colo., has been appointed resident engineer on the construction of the 110-mile line between Childress and Pampa, Tex., for the Fort Worth & Denver Northern Ry. (an extension of the Colorado & Southern Ry.).

S. T. WELLER, resident engineer for the Denver Waterworks Co., Denver, Colo., has resigned his position to become state inspector on the Eleven Mile Canyon Dam, now under construction. J. H. COLEY, previously assistant to Mr. Weller, is now resident engineer.

RALPH J. REED, consulting engineer, of Los Angeles, Calif., has been appointed a member of the board of registration for civil engineers, to succeed Donald M. Baker, Los Angeles, whose term has expired. Mr. Baker had been president of the board since its organization in October, 1929.

RUFUS W. PUTNAM, past-president of the Western Society of Engineers, has been appointed director of the Chicago Regional Port Commission. This is a new municipal body created by joint legislation of Illinois and Indiana to have jurisdiction over a harbor district to be created somewhat along the lines of the port authorities governing New York and other large ports.

S. E. BRASWELL, of Atlanta, Ga., who has recently been employed by the bridge department, state highway board of Georgia, Atlanta, Ga., has been appointed assistant highway engineer, Bureau of Public Roads, for duty in Ohio, with headquarters at Columbus. Previously Mr. Braswell was with the division of streets, Miami, Fla.

S. F. CRECELIUS, formerly city engineer of El Paso, Tex., is now engineer of the International Water Commission, with headquarters at San Benito, Tex. The surveys of floodways in the Rio Grande delta are nearing completion and the organization will soon make surveys of reservoir sites on the Rio Grande for storage of water for flood control, irrigation and power development.

H. T. FLASHER has returned to his position as assistant division engineer of the state highway department, Ashland, Ohio, in charge of maintenance work. During the last half of 1929 and during 1930 Mr. Flasher was on leave of absence and was engaged as engineer of construction for the city of Tiffin, Ohio, on the building of the $100,000 Rock Creek improvement, consisting of building about half a mile of concrete retaining walls and about 1½ miles of channel excavation.

FRANK G. WHITE has been appointed chief engineer of the California board of state harbor commissioners. This appointment was made to conform with the new state law, which went into effect Aug. 14, making the chief engineer an outright employee of the harbor board, serving at the board's pleasure. Previously Mr. White, who has been an employee of the harbor board for twenty years and for fifteen years of this period has been chief engineer, has been technically under the state department of engineering, assigned to the harbor board, although his salary has been paid by the harbor board.

Obituary

JAMES W. BILLINGSLY, consulting engineer, of New Orleans, La., died on Aug. 17 in St. Luke's Hospital, Chicago, Ill., where he had been a patient for six months. Mr. Billingsly was 51 years old.

JOHN JOSEPH ALBRIGHT, of Buffalo, N. Y., died in that city on Aug. 20 at the age of 83. Mr. Albright was a pioneer in the development of Niagara Falls water power in New York State and Canada. He was a member of the American Society of Civil Engineers.

HENRY J. COLLIER, superintendent of bridges and buildings for the Denver & Rio Grande Western R.R., died suddenly on Aug. 15 from a heart attack while supervising some work in DeBeque, Colo. Mr. Collier, who was 64 years old, had been connected with the company for 30 years.

SAMUEL G. STALLMAN, a civil engineer in the city engineer's office of Rochester, N. Y., died on Aug. 21. Previous to joining the city engineer's force he was associated with George R. Newell, consulting engineer, Rochester, and later with the United States housing bureau. He was a member of the Rochester Engineering Society.

EDWIN HARRISON MCHENRY, former engineering vice-president of the New York, New Haven & Hartford and Boston & Maine railroads, died on Aug. 21 at his home in Ardmore, a suburb of Philadelphia. He was 72 years old. Mr. McHenry began his engineering work in 1883 as a rodman on the Northern Pacific Railway. In ten years he was advanced from rodman to chief engineer, holding the last-named position from 1893 to 1896. During the latter part of that period he was also receiver for the road. He resigned in 1901, and after spending two years in Japan, China and the Philippine Islands, he became chief engineer of the Canadian Pacific Railway. In 1904 he was made vice-president in charge of construction, operation and maintenance of electric railway lines of the New York, New Haven & Hartford Railroad and in 1911 was given a similar position with the Boston & Maine. For the New Haven road he supervised the electrification of the lines from Stamford, Conn., to New York City and through the Hoosac tunnel. He resigned from the vice-presidency of both railroads in 1913.

SOCIETY CALENDAR

AMERICAN ASSOCIATION OF ENGINEERS, Chicago; annual convention, Huntington, W. Va., Sept. 28-30.

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS, Washington; annual meeting, Sept. 28-Oct. 1, Salt Lake City.

AMERICAN PUBLIC HEALTH ASSOCIATION, New York; annual convention, Montreal, Sept. 14-17.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; fall meeting, St. Paul, Minn., Oct. 7-9.

AMERICAN SOCIETY OF MUNICIPAL ENGINEERS, St. Louis; meeting, Oct. 19-26, Pittsburgh.

AMERICAN WELDING SOCIETY, New York City; fall meeting, Sept. 21-25, Boston.

INTERNATIONAL CITY MANAGERS ASSOCIATION, Chicago; annual meeting, Oct. 7-10, Louisville, Ky.

INTERNATIONAL ASSOCIATION OF PUBLIC WORKS OFFICIALS, Chicago; conference, Sept. 24-26, New York City.

NATIONAL MUNICIPAL LEAGUE, New York City; annual meeting, Nov. 9-11, Buffalo, N. Y.

NATIONAL SAFETY COUNCIL, New York City; twentieth annual safety congress, Chicago, Oct. 12-16.

NEW ENGLAND WATER WORKS ASSOCIATION, Boston; annual convention, Sept. 29-Oct. 2, Boston.

CANADIAN GOOD ROADS ASSOCIATION will hold its annual convention at Lucerne-in-Quebec Sept. 22-23. One of the topics to be discussed will be prevention of highway accidents due to increase of motor traffic. Uniform traffic laws and regulations have been steadily urged by the association.

CONFERENCE OF STATE SANITARY ENGINEERS will meet Sept. 12-14 in Montreal. The secretary is R. E. Tarbett, U. S. Public Health Service, Washington, D. C.

ENGINEERING INSTITUTE OF CANADA will hold its next annual meeting in Toronto Feb. 3-5.

NATIONAL COUNCIL OF STATE BOARDS OF EXAMINING ENGINEERS will hold its twelfth annual convention in Detroit, Mich., Oct. 1-3.

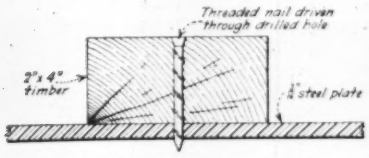
PITTSBURGH CHAPTER, American Society for Steel Treating, is offering a series of fifteen lectures on "Basic Principles of Metallurgy" on Tuesday evenings from Sept. 8 to Dec. 15.

ROADMASTERS AND MAINTENANCE-OF-WAY ASSOCIATION will hold its 49th annual convention in Chicago, Sept. 22-24. Committee reports will discuss: (1) water pockets, their cause and cure; (2) protection of trackmen working under traffic; (3) routine track inspection; (4) failed rails, their causes, detection and disposition; (5) methods of handling snow and ice on railroads. The secretary is T. F. Donahoe, Baltimore & Ohio R.R., 428 Mansion St., Pittsburgh, Pa.

Construction Equipment and Materials

Attaching Wooden Sleepers to Battledeck Floors

A method of attaching wooden sleepers to steel floors of the battledeck type was exhibited at a demonstration of this type of construction recently staged at Cleveland, Ohio, by the Carnegie Steel Co. and the Lincoln Electric Co. It involves the use of a patented nail of special steel manufactured by the Hill Wood Mfg. Co., Cleveland, which automatically threads itself into the steel as it is driven. The nails are used to bind wood 2x4's to the steel plates and are driven through drilled holes passing through both timber and plate. Attempts to remove the wood strip by the use of wedges resulted in tearing off the strip without bending or starting the nail.

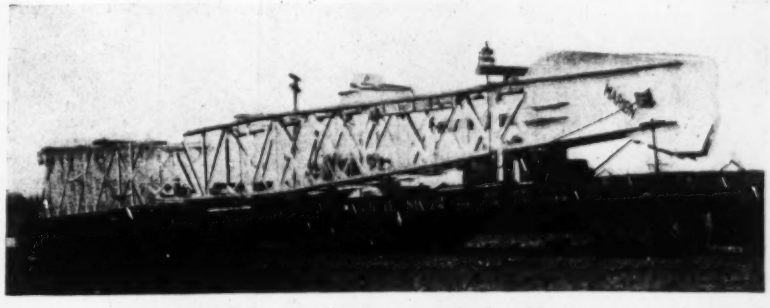


Fastening timber to steel plate

Large Dragline Boom Built of Aluminum Alloy

For use on Mississippi River levee construction, the Marion Steam Shovel Co., Marion, Ohio, has just completed a 150-ft. dragline boom constructed largely of duralumin, an aluminum alloy with a weight about one-third that of steel. Of the structural material used only 18 per cent is steel, these parts including the jaw plates and diagonal bracing at the foot of the boom, also the plates for attaching the boom support and side cables and the rivets. All other parts are of duralumin. The total weight of the complete boom is 34,400 lb., compared with 51,000 lb. for an all-steel boom of the same length and construction. It is made for attachment to a Marion Type 5240 dragline.

Advantages of the new construction include a decrease in the gross weight of the excavator, an advantage when working in soft ground; ability to handle a larger bucket at the same working range; and the fact that it is now possible to use a 25-ft. extension with the standard bucket, whereas the 150-ft. boom of all-steel construction was the longest that could be used with this machine heretofore. Also, it is now necessary to divide the boom into only two sections for handling, shipping and assembling in the field, whereas with the steel boom it is necessary to use three sections because of weight limitations.



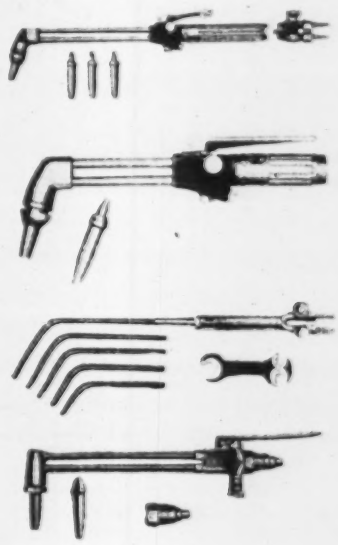
Aluminum dragline boom ready for shipment

Welding and Cutting Torches

Several new additions to its line of welding and cutting apparatus have been announced by the Linde Air Products Co., 205 East 42d St., New York City. These include the Prest-O-Weld Type C-105 cutting blowpipe and Type CW-105 cutting attachment, as well as the No. 21 cutting attachment and No. 11 welding torch now included in the line of Purox medium pressure apparatus for oxyacetylene work.

The two pieces of Prest-O-Weld cutting equipment, as well as the older Type W-105 and W-106 welding blowpipes, can all be used interchangeably with the same detachable valve body. This makes it possible for the operator to change quickly from a full-size welding blowpipe to a smaller welding blowpipe, to a full-size cutting blowpipe or to a cutting attachment without detaching the hose connections. The locking device for connecting the detachable valve body consists of a locking bolt and a wedge-shaped locking screw. The latter is operated by turning a ring and draws the detachable valve body and blowpipe handle together, making a gas-tight joint. Pressure forgings are used in the construction of the blowpipe head, cutting valve body and lever. The cutting oxygen tube is made of Ambrac, a special hard brass. The cutting nozzles have conical seats so designed that they will not become nicked or damaged when accidentally dropped. Four cutting nozzles are standard equipment with the blowpipe, as well as a 75-deg. head, although a 90-deg. head can be furnished. The Type CW-105 cutting attachment is of the single joint design and will readily cut metal up to 2 in. in thickness. As it measures only 11 in. over all, it can be conveniently carried in the pocket when not in use.

The Purox No. 11 welding torch has a very wide range extending from the lightest sheet metal up to work as heavy as ½-in. plate. Tips are of one-piece, hard-drawn copper construction and are so designed that the head angle can be easily adjusted. Five sizes are furnished as standard equipment. The No. 21 cutting attachment, designed for use with this torch, will cut metal up to 2 in. in thickness and is furnished with one- and two-piece cutting tips. This is the lightest cutting attachment on the market, weighing only 1 lb. 8 oz. An adaptor is also available which makes it possible to use this outfit with the Purox No. 20 welding torch.



Cutting and welding equipment

Top to bottom: Prest-O-Weld Type C-105 cutting blowpipe and Type CW-105 cutting attachment; Purox No. 11 welding torch and No. 21 cutting attachment.

Large Portable Air Hoist

An additional air-operated utility hoist with a longer drum and a greater cable capacity than former models has been announced by the Ingersoll-Rand Co., 11 Broadway, New York City. This unit has a capacity for 2,900 ft. of 1/4-in. cable, or 800 ft. of 1/2 in. Its rated working capacity at 80 lb. air pressure is 2,000 lb. at a rope speed of 120 ft. per minute. The air motor is a reversible, four-cylinder, radial-piston type, with ball or roller bearings throughout. Connection to the drum is provided by a jaw-type clutch, and a

(Continued on p. 350)

Current Construction Unit Prices

Cle Elum Dam in Washington State

CLE ELUM reservoir, under construction for the U. S. Bureau of Reclamation, is located at Cle Elum Lake near Cle Elum, Wash., a point on the Northern Pacific and the Chicago, Milwaukee, St. Paul & Pacific railways 100 miles southeast of Seattle. Work consists of a dam of sprinkled and rolled earth and gravel fill, with extensive blankets of earth on the lake side and gravel and cobbles on the downstream side, totaling 1,235,000 cu.yd. of materials. The purpose is to furnish additional storage for irrigating the Yakima project by raising the surface of the lake 120 ft., by means of control works at the outlet.

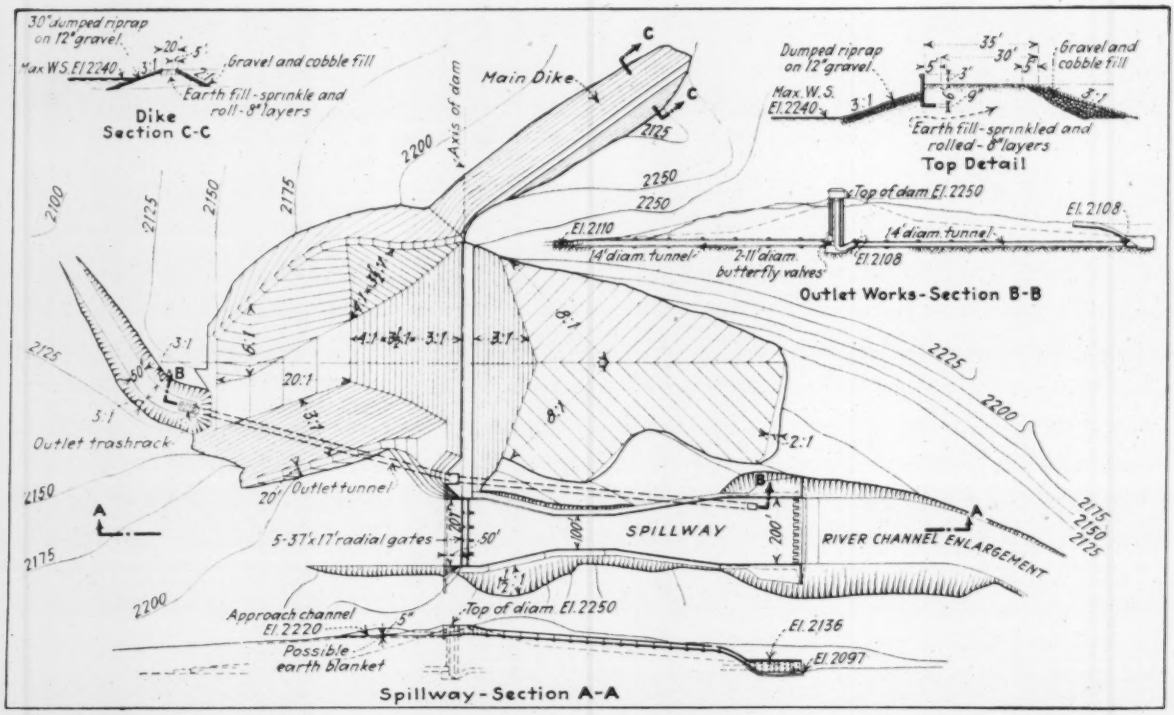
Storage is released by an outlet tunnel through the right abutment. The tunnel is 14 ft. diam. inside concrete lining and 1,800 ft. long, and includes a short open section. Outflow is controlled by tandem cylinder gates located in a vertical shaft at the middle of the tunnel. These cylinder gates are protected by two emergency gates of the butterfly type, 11 ft. in diameter. The abutment through which the tunnel and shaft will be driven is mainly gravel.

A spillway channel of reinforced concrete will be built over the right abutment, ending in a spilling basin at the lower end of the outlet tunnel. The river channel will be straightened, deepened and enlarged for about a mile below this outlet.

Material for the dam will be obtained from excavation for the spillway and outlet channel and from nearby borrow pits. The area to be submerged, amounting to 2,700 acres, is covered with second growth timber and brush which will be cleared and burned.

The government will furnish cement, sand and broken rock or gravel for use in concrete; cement and sand for grout; reinforcing bars; anchor bars, rods and bolts; metal pipe; drain pipe; conduit lining castings for outlet work; gates and hoists; traveling cranes; operating machinery; structural steel for trash rack, cylinder gate operating house, and other structures; steel sheetpiling; stoplogs for

	A	B	C
Removal of old crib dam (lump sum)	$3,000.00	$20,000.00	$15,000.00
Clearing reservoir site (lump sum)	8,940.00	7,500.00	19,000.00
Diversion and care of river during construction and unwatering foundation (lump sum)	18,000.00	45,000.00	18,000.00
Clearing and grubbing for embankments, structure sites and borrowpits, 60 acres	240.00	200.00	300.00
Stripping for embankments, 44,000 cu.yd.	0.24	0.40	0.35
Stripping for borrowpits and structure sites, 90,000 cu.yd.	0.20	0.30	0.20
Plowing foundations for embankments, 19 acres	20.00	20.00	50.00
Excav. for approach channel to outlet trash-rock structure, 22,000 cu.yd.	0.40	0.30	1.00
Excav. in open cut for outlet tunnel and trash-rock structure, 4,000 cu.yd.	0.35	1.00	1.00
Excav. in outlet tunnel, 18,000 cu.yd.	10.50	5.00	11.00
Excav. in gate shaft, 6,500 cu.yd.	9.50	6.00	15.00
Excav. for cutoff trench under dam embankment, 20,000 cu.yd.	0.40	0.30	1.00
Excav. for earth blankets on upstream slopes, 17,000 cu.yd.	0.34	0.40	0.25
Excav. for spillway, including approach channel and stilling basin, 405,000 cu.yd.	0.29	0.15	0.18
Excav. for constructing new river channel to be used in dam or blankets, 240,000 cu.yd.	0.27	0.15	0.18
(Alternative) Excav. for deepening and enlarging present river channel to be used in dam or blankets, 240,000 cu.yd.	0.29	0.25	0.18
Excav. for constructing new river channel to be wasted, 207,000 cu.yd.	0.15	0.15	0.22
(Alternative) Excav. for deepening and enlarging present river channel to be wasted 142,000 cu.yd.	0.24	0.25	0.40
Excav. in borrowpits, 637,000 cu.yd.	0.26	0.15	0.16
Backfill about structures,, 35,000 cu.yd.	0.40	0.40	0.30
Pressure grouting outlet tunnel and cylinder-gate shaft, 20,000 cu.ft.	1.00	1.00	1.00
Earth embankment in dam and main dike, 673,000 cu.yd.	0.12	0.25	0.22
Earth embankment in earth blankets, 110,000 cu.yd.	0.12	0.25	0.25
Earth embankment in saddle dikes, 2,800 cu.yd.	0.20	0.40	0.35
Gravel and cobble embankment in dam and dikes, 130,000 cu.yd.	0.12	0.25	0.23
Gravel and cobble embankment in blankets, 282,800 cu.yd.	0.12	0.25	0.23
Placing 12-in. gravel blanket under dumped riprap on portions of dam, earth blankets and main dike, 16,000 cu.yd.	0.40	0.40	0.35
Placing 12-in. gravel blanket under dumped riprap on saddle dikes, 150 cu.yd.	0.50	0.60	1.00



Plan and sections of dam spillway and outlet works of Cle Elum Dam

Current Construction Unit Prices

	A	B	C
Dumped riprap on dam, dikes and blanket, 40,000 cu.yd	1.20	2.00	1.50
Placing dry rock paving around trash-rock structure, 1,800 cu.yd	1.40	3.00	3.00
Placing grouted paving below stilling basin, 2,100 cu.yd	2.50	4.50	5.00
Placing gravel blanket under spillway floor, and ground drainpipe, 6,000 cu.yd	1.00	1.00	1.30
Placing 6-in. drainpipe under spillway floor, 2,500 lin.ft	0.25	1.00	0.30
Placing 12-in. drainpipe under spillway floor, 100 lin.ft	0.55	1.20	0.60
Placing 18-in.drainpipe under spillway floor, 300 lin.ft	1.00	2.00	1.00
Placing 24-in.drainpipe under spillway floor, 400 lin.ft	2.00	2.50	1.50
Placing 30-in.drainpipe under spillway floor, 510 lin.ft	2.75	3.00	2.50
Conc. in parapet on dam, 300 cu.yd	15.00	20.00	5.00
Conc. in trash-rock structure and transition, 250 cu.yd	12.00	20.00	15.00
Conc. in outlet tunnel in open cut, 1,400 cu.yd	11.50	12.00	10.00
Conc. in outlet tunnel in tunnel section, 6,100 cu.yd	7.80	10.00	9.00
Conc. in cylinder-gate shaft, butterfly-gate structure and transition, 3,600 cu.yd	14.00	15.00	13.00
Conc. in spillway-gate structure, 3,400 cu.yd	7.00	10.00	9.00
Conc. in spillway-channel floor and cut-offs, 6,700 cu.yd	4.50	8.00	6.00
Conc. in stilling-basin floor and cutoffs, 4,700 cu.yd	6.00	8.00	7.00
Conc. in spillway channel and stilling-basin walls, counter forts and footings, 4,500 cu.yd	14.00	10.00	10.00
Conc. in dentated sills, 742 cu.yd	8.00	12.00	7.00
Conc. in tunnel ventilator and drain shaft and stilling basin drainage well, 160 cu.yd	17.00	15.00	16.00
Conc. in cylinder-gate operating house, 350 cu.yd	33.00	12.00	20.00
Placing reinforcement bars, 3,940,000 lb	0.02	0.015	0.015
Driving sheetpiling, 10,400 lin.ft	0.30	0.20	0.45
Placing grout pipe and fittings, 7,500 lb	0.20	0.05	0.20
Erection of cylinder-gate operating house except concrete, (lump sum)	600.00	11,500.00	1,750.00
Installing and painting trash-rock metal work, 90,000 lb	0.02	0.035	0.02
Installing and painting butterfly gates, frames and metal conduit linings, 197,000 lb	0.04	0.035	0.25
Installing and painting butterfly gate operating mechanism, stems, hoists, motors, etc., 24,000 lb	0.045	0.035	0.08
Installing and painting cylinder gates, guides and seals, 84,600 lb	0.06	0.035	0.03
Installing and painting hoists, shafts, stems, and other operating mechanism for cylinder gates, 80,400 lb	0.045	0.035	0.03
Installing and painting 20-ton traveling crane, hoists and rails, and 5-ton trolley hoists and I-beam track, 29,500 lb	0.03	0.035	0.05
Installing and painting spiral stairway handrailing, and miscellaneous metal work, 40,000 lb	0.02	0.035	0.08
Installing and painting standard pipe, fittings, and valves, 87,500 lb	0.02	0.05	0.04
Installing electric conduits, fittings, and boxes, 3,500 lin.ft	0.15	0.40	0.25
Installing electric conductors, fittings, and apparatus, complete (lump sum)	450.00	750.00	1,000.00
Totals	$1,311,534	$1,339,017	$1,424,108

inlet to outlet tunnel; pipe for hand rail; doors, windows, hardware and roofing for the cylinder gate operating house; metal floor plates and stairways; sheet metal for sheet-metal work; paint materials; electrical conduit, and all other materials that will become a part of the completed construction work. Delivery is f.o.b. cars at Ronald, Wash., on the branch line of the Northern Pacific Railroad from Cle Elum.

Contractor furnishes form materials; tunnel and shaft timbering; steel liner plates and ribs for tunnel and shaft lining; rock for dry rock paving and grouted paving; all other materials that will not become a part of the completed structure.

Bids were asked on two schedules, the first including all work except clearing most of the site. Schedule 2 covers clearing the reservoir site, except for a small section included in schedule 1. Complete unit prices are given of the lowest three bidders on schedule 1. The items are in three principal groups: (1) excavation; (2) embankments; (3) concrete. The ten excavation items total $602,000 of the total contract price of $1,311,534, or 46 per cent. Embankment items total $199,000, or 15 per cent. Concrete items, exclusive of placing reinforcement, total $288,000, or 22 per cent. These three operations, therefore, account for 83 per cent of the total cost. Placing reinforcement is estimated at $69,800, or 5 per cent of total cost, or 19.5 per cent of the cost of placing concrete including reinforcing bars.

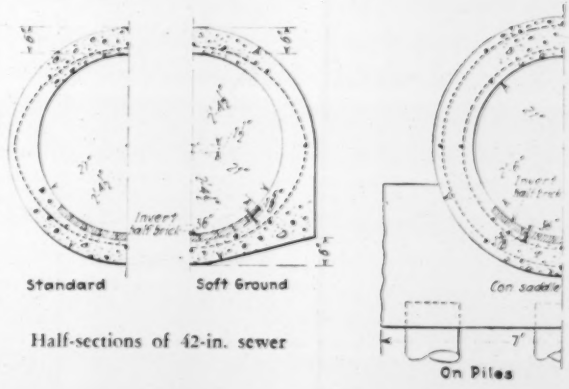
Eighteen bids were received July 10, 1931. Lowest three bidders on schedule 1 were: A, Winston Bros. Co., 1470 Northwestern Bank Bldg., Minneapolis, contract; B, George Nelson, 231 Summit Ave., Seattle, $1,339,017; C, McDonald & Kahn, San Francisco, and Morrison-Knutson, Boise, $1,424,108. The contractor on schedule 2, for clearing site, is Siems-Helmers, Inc., 1014 Guardian Bldg., St. Paul, $291,600. A. F. Walter is chief engineer, Bureau of Reclamation, Denver.

Trunk Sewer in Seattle

CHARLESTOWN ST. trunk sewer in Seattle, Wash., awarded for $159,190 in May, 1931, includes connecting sewers, stormwater overflows and outfalls, manholes, gate chambers, lateral sewer connections, side sewer connections, pumping plants, and force mains. The sewer will handle the flow from numerous lateral sewers now discharging into Lake Washington and deliver it to pumping plants for elevation to main trunk sewers discharging into Puget Sound. The vitrified clay pipe, costing 10 per cent of the contract price, is triple strength with precast bituminous joints. Principal contract unit prices are given and the average prices of the six bidders. Work is being done by the Queens City Construction Co., 603 Eighteenth Ave., Seattle. G. W. McMorris is city engineer; O. C. Piper, principal assistant city engineer.

Quantities Per Linear Foot	Standard	Soft Ground	On Piles
Concrete, cu.ft	7.11	8.35	9.60
Steel, lb	16.00	16.00	40.20
Half brick, no	13.40	13.40	13.40

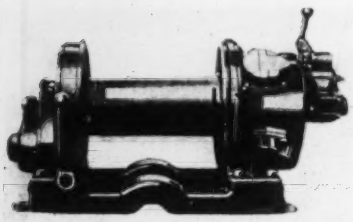
Clay Pipe	Contract Price	Average 6 Bids
820 ft. 8 in	$1.50	$2.27
3,600 ft. 15 in	3.00	3.40
20 ft. 18 in	4.50	4.24
1,175 ft. 21 in	4.55	4.88
42-in. Sewer		
964 ft. rein.-conc	9.00	15.68
50 ft. rein.-conc. in soft ground	12.00	16.69
640 ft. rein. conc. on piles	8.50	13.12
1,897 ft. brick in tunnel	15.00	19.94
2,000 ft. 8-in. subdrain	.70	.75
20 cu.yd. sand-gravel foundation	5.00	4.17
50 cu.yd. conc. foundation	13.00	11.50
60 cu.yd. conc. seal	13.00	13.17
1,000 lb. add'l reinf. steel in place	.10	.06
165 cu.yd. conc. in saddles	11.00	12.32
40 lin.ft. 14-in. pipe relaid	2.00	2.83
50 ft. 8-in. sand-cast cl. A force main	2.00	2.13
120 ft. 10-in. sand-cast cl. A force main	3.50	2.87
15 ft. 20-in. sand-cast cl. A force main	5.50	6.00
432 ft. 16-in. submerged storm outfall	10.00	11.11
396 ft. 36-in. submerged storm outfall	20.00	21.83
6,370 ft. plain peeled piles in place	.45	.45



Half-sections of 42-in. sewer

Portable Air Hoist

(Continued from p. 353)



Air-operated hoist

brake of the external contracting type is used. The new hoist, known as model HUL, can be employed wherever a portable hoist is required.

Cutting and Welding Torch

A lightweight cutting and welding torch that is rugged and durable in construction has been announced by the Alexander Milburn Co., 1416 West Baltimore St., Baltimore, Md. The principal parts are of forged bronze and the tubes of nickel silver, assuring

Oxyacetylene torch and tips

strength, rigidity and long life. The patented leakproof, high-pressure valve, which is readily accessible, and the seats may be renewed without disassembling the handle or other parts. The head is designed to take conical seated cutting tips Nos. 1 to 8. The change from a cutting torch into a welding torch is made by the use of an adaptor.

Business Notes

FEDERAL TRADE COMMISSION, Washington, D. C., has announced the acceptance of trade practice conference rules for the following industries: Cut stone, crushed stone, face brick, steel window manufacturers and steel fabricators.

AMERICAN STANDARDS ASSOCIATION, New York City, has approved tentative standard specifications for zinc-coated (galvanized) sheets of bessemer and open-hearth steel and of open-hearth iron. Five classes of zinc coatings applied by the hot-dip process are covered in the specifications. The association has also approved eight new standards for wood poles, each covering ten classes of poles. Copies of these standards may be obtained from the association at 29 West 39th St., New York City, at a nominal cost.

WORTHINGTON PUMP & MACHINERY CORP., Harrison, N. J., has acquired the manufacturing and marketing facilities of Metalweld, Inc., Philadelphia, Pa., builder of portable air compressors. Engineering, manufacturing and sales activities will be centered at Harrison. Metalweld, Inc., will continue to sell and service Worthington contractors' equipment in the Philadelphia district and will also carry on its general welding repair business and that of its subsidiary company, the Philadelphia Compressor Rental Co.

AMES BALDWIN WYOMING SHOVEL CO. has been formed to take over the shovel interests of the Ames Shovel & Tool Co., Hubbard & Co., Wyoming Shovel Works, Pittsburgh Shovel Co. and Baldwin Tool Works. The new company will operate plants of the organizations named, and will maintain executive offices, for the present, at North Easton, Mass. Sales offices will be maintained in New York City, Chicago and Pittsburgh. Officers include Richard Harte, president; N. T. Jacobs, in charge of sales; and L. J. Reay, treasurer.

KALMAN STEEL CORP., recently taken over by the Bethlehem Steel Corp. (*ENR*, July 16, p. 113), has announced the appointment of the following officers: Paul Mackall, president; George E. Routh, Jr., vice-president, sales; Quincy Bent, vice-president, operations; R. E. McMath, vice-president and secretary; Robert Young, treasurer; F. A. Shick, comptroller; Charles R. Holton, purchasing agent. A. P. Clark continues as general manager of sales. Virtually the entire selling organization of the former company is retained; head offices will be at Bethlehem, Pa.

INTERSTATE EQUIPMENT CORP., 25 Church St., New York City, announces the consolidation of B&B aerial tramways, formerly manufactured by the Broderick & Bascom Rope Co., St. Louis, Mo., and Automatic aerial tramways. Both types of equipment will hereafter be handled through the tramway department of the Interstate Equipment Corp., and both will be manufactured by it at Roanoke, Va. F. W. Grice, who has been in charge of the tramway department for B&B, will act as consulting engineer for Interstate Equipment, making his headquarters at St. Louis, as before.

ALBERT PIPE SUPPLY CO., INC., Berry and North Thirteenth Sts., Brooklyn, N. Y., and purchased the entire stock of the McDowell Pipe Corp., also of Brooklyn, consisting of 3,000 tons of new black and galvanized pipe in sizes from ⅛ to 24 in. diameter.

SCOTT STEEL CO., 110 South Dearborn St., Chicago, Ill., has established a sheetpiling and rail department under the management of Charles I. Lamm, formerly sales manager of S. W. Lindheimer, Inc. The latter company has retired from business and has turned over its complete inventory to the Scott Steel Co.

M. M. GEDNEY CO., Fort Wayne, Ind., has been formed to engage in the sale and rental of construction equipment. A branch office has also been established in Rockford, Ill. Directing the new organization is M. M. Gedney, formerly associated with the M. M. Gedney Construction Co., contractor.

ROBERT W. HUNT CO., Chicago, Ill., has added to its facilities an X-ray laboratory of modern design and ample capacity for industrial requirements. Facilities are available to X-ray materials up to 3½ in. thick for steel, or 8 in. for aluminum.

NORMA-HOFFMAN BEARINGS CORP., Stamford, Conn., has opened a sales office at 1014 American Bank Building, Cincinnati, Ohio. C. D. Kilham, lately at the Cleveland office, has been made manager in charge.

GLEDHILL ROAD MACHINERY CO., Galion, Ohio, has broken ground for its new factory. The first unit will be 90x200 ft. in size.

REVERE COPPER AND BRASS INCORPORATED has announced the appointment of C. A. Macfie as assistant sales manager, with headquarters at 230 Park Ave., New York City.

KERNER INCINERATOR CO., Milwaukee, Wis., has taken over the national distribution of Andelco light-proof curtains and Bennett fireplace units.

RIC-WIL CO., Cleveland, Ohio, has purchased the Standard Underground Conduit Co., of Atlanta, Ga.

ORLANDO WARE, treasurer of James B. Clow & Sons, Chicago, Ill., died Aug. 2 at the age of 72, after more than 30 years of continuous service with that firm.

GRADER USED TO RESTORE IRRIGATION DITCH SLOPES

One of the most troublesome maintenance jobs in connection with irrigation is the periodical top and botton grading of ditch banks to restore the original slope and to remove growths that impede the current. This operation is usually done either by a dragline or by a large wooden "V" with grader cutting edges attached. Both methods are expensive, and the second suffers from the additional disadvantage of being difficult to control. The possibility of substituting standard grading equipment for this work was demonstrated last spring on the Gem Irrigation District at Homedale, Idaho, where a Caterpillar 60 leaning wheel grader was used in conjunction with two Caterpillar 30 tractors. A few minor changes were made in the grader: the left end of the moldboard was reduced 1 ft. in length; two 3-ft. extensions, welded together, were added to the right end of the blade; the extension was connected to the frame with a spring brace; and the arm from the circle to the side shifting rack was shortened. Results of the demonstration indicate that this outfit should berm about 8 miles of ditch per day. The two 30-hp. tractors were used instead of a single 60-hp. unit because of bridge weight limitations.

CONSTRUCTION NEWS

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Some of the Week's Large Projects

For further details turn to the appropriate sections in this issue

Location	Project	Cost	Status
Bridges			
Bedford (Ohio)	Bridge	$1,200,000	Proposed
Canada	Bridge	2,000,000	Proposed
Railways			
Texas	Railroad Ext	4,000,000	Contract
Unclassified			
Dallas (Tex.)	Cemetery	1,500,000	Proposed
Federal Government			
Miami (Fla.)	Post office and court house	2,080,000	Bids asked
Cle Elum (Wash.)	Dam	1,603,134	Contract
Chattanooga (Tenn.)	Post office	1,000,000	Proposed
Fort Sam Houston (Tex.)	Hospital	2,000,000	Proposed
Power Plants			
New York	Power plant additions, etc	2,500,000	Day labor
Buildings			
Boston	Publishing and service plant	3,000,000	Contract

WATERWORKS

PROPOSED WORK

Calif., Long Beach—City Council 22 m.g. storage reservoir for Long Beach Water Dpt. $290,000. **Maturity this fall.** A. H. Adams, City Hall, engr.

Calif., Los Angeles—See "Dams."

Calif., Mill Valley—Marin Municipal Dist., San Rafael, extending mains in Mill Valley for fire protection. $63,000. Eng. Dpt. of District engrs.

Ia., Estherville—City, c/o City Clerk, filtration and purification plant, $33,000. Project indefinitely postponed. Howard R. Green Co., Bever Bldg., Cedar Rapids, engrs. Noted Mar. 19.

Minn., Byron—Village constructing complete waterworks, $20,000. Druar & Milinowski, 904 Globe Bldg., St. Paul, engrs.

Minn., Ely—City Council A. O. Kunston, city clk., soon takes bids furnishing material, laying 5 mi. 14 in. steel water pipe from Burnside Lake to City, 500 ft. intake pipe, 25,200 ft. discharge pipe; also plans pump house and purchasing 3 pumps next year. $200,000. Oliver Iron Mining Co., c/o M. W. Willis-Wolvin Bldg., Duluth, engrs.

Ohio—See "Hospitals."

O., Cincinnati—Water and power plant, $2,700,000. Project in obeyance. Burns & McDonnell Eng. Co., 400 Interstate Bldg., Kansas City, Mo., engrs. Noted May 21.

Que., Three Rivers—City, A. Beliveau, clk., water intake, water and sewer mains, paving, $554,000. Z. Lambert, city engr.

Que., Verdun—City, A. J. Burgess, city clk., 8 m.g.p.d. filtration plant, $450,000. Crepeau & Hunter, 1112 Dominion Sq. Bldg., consult. engrs.

BIDS ASKED

Calif., Calexico—Sept. 1, by R. S. Emerson, city clk., furnishing 1,000 g.p.m. horizontal pump with motor.

Ind., Peru—Sept. 8, by Common Council at office H. E. Worl, city clk., City Bldg., complete iron removal and filtration plant, accessories, miscellaneous equipment, $150,000. C. Brossman, 1010 Chamber of Commerce Bldg., Indianapolis, consult. engr.

Mass., Boston—Sept. 8, by Metropolitan Dist. Water Supply Comn., 20 Somerset St., sinking two 12 x 32 ft. caissons and scaling to ledge, 3 mi. apart, to form parts cut-off walls for main dam and dike of Swift River Reservoir, Enfield and Ware. F. E. Winsor, Metropolitan Dist. Comn., engr.; adv. E. N.-R. Aug. 27.

Mont., Hot Springs—Aug. 31, by City Council, waterworks incl. 2,300 lin.ft. 8 in. and 13,907 ft. 6 in. c.i. pipe, 27 gate valves, 75,000 gal. steel or wood tank in place, pump house, centrifugal pump, deep well. $30,000. N. Hood, city clk.

N. J., Boonton—Sept. 8, by Mayor and Bd. Aldermen, Town Hall, 12 in. transmission main extending from wells in Rockaway Valley to connection with its distribution system at corner of Main St. and Highland Ave. A. P. Smith, town clk.; adv. E. N.-R. Aug. 27.

N. J., Orange—Sept. 1, by Bd. City Comrs., City Hall, water pumping and electric lighting plant, Chestnut St. $425,000. Runyon & Carey, 31 Fulton St., Newark, engrs. Noted Aug. 19.

Pa., Ridgway—Sept. 8, at office G. F. Greiner, boro. secy., Ridgway Natl. Bank Bldg., c.i. water pipe line, Contr. 3; adv. E. N.-R. Aug. 27.

Wash., Wenatchee—Sept. 8, by City Comrs., 4 m.g.p.d. rein.-con. reservoir, $75,000. F. Sharkey, Wenatchee, engr.

Alta., Calgary—Sept. 4, by A. S. Chapman, city engr., general contract superstructure waterworks filtration plant; Sept. 11, equipment for same. $300,000.

Ont., Arthur—See "Contracts Awarded."

CONTRACTS AWARDED

N. Y., Brooklyn—Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., New York, conduits between Shaft 23 of City Tunnel 1 and Shaft 16-A of City Tunnel 2, 3rd Ave., Schermerhorn, Nevins and State Sts., to Bronx Waterworks Corn., 1 Riverdale Ave., New York, $230,865. Noted July 23.

N. Y., Brooklyn—J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., New Yorok, hauling, laying mains, Avenue I et al., to Ialenti Bros. Co., $5,000; Avenue X et al., to Ozone Water Pipe Constr. Co., $13,800. Noted Aug. 6.

N. Y., Long Island City—J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., New York, hauling, laying mains in 35th Ave., et al., to S. Gallucci & Son, Railroad Ave., Corona, $11,331. Noted Aug. 6.

Ont., Arthur—Village, waterworks, day labor, under supervision Ontario Eng. Co., Fort Erie, $45,000. Noted May 21.

Ont., Toronto—City, constructing junction shaft and submerged intake tunnel into Lake Ontario in connection with new duplicate waterworks, to Foundation Co. of Ontario, Temple Bldg., $788,900.

Ont., Ottawa—Bd. Control, Transportation Bldg., altering and constructing pumping station and laboratory building in connection with water filtration plant, to Henri Dagenais Ltd., St. Patrick St., $155,658. Est. $150,000. Noted July 30.

SEWERS

PROPOSED WORK

Calif., Los Angeles—Los Angeles Co. South Bay Cities Sanitation Dist. in Esplanada from Sapphire St. to Ainsworth Court, incl. 1,000 ft. 18 in. pipe. A. K. Warren, 139 North Bway., engr.

N. J., Bound Brook—Bd. Boro Council, Boro Hall, municipal sewage disposal plant, $25,000. Engineer not appointed.

Mich., Dearborn—City, Sect. 56, Interceptor Sewer, 1,100 ft. 10 ft. diam. monolithic concrete, brick or block in tunnel, to serve west side disposal works under contract. M. B. Owen, City Hall, engr.

Ont., Port Stanley—City Council sanitary sewerage system, incl. 2 pumping stations, $85,000. F. A. Dallyn, 71 King St. W., Toronto, engr.

Que., Three Rivers—See "Waterworks."

BIDS ASKED

N. Y., Syracuse—Aug. 31, by Bd. Contr. & Supply, City Hall, sanitary sewers in Rice St. Sect., $31,000. W. W. Cronin, State Tower Bldg., engr.

Minn., Minneapolis—See "Contracts Awarded."

N. J., Princeton—Sept. 15, by Mayor and Council, 68,800 ft. trunk sewers, sewage treatment plant. $850,000.

N. J., Ventnor (Bd. Atlantic City)—Aug. 31, by Joint Meeting of Ventnor and Margate Cities, City Hall, joint sewage treatment plant incl. settling tanks, sludge pump and chlorination station, sludge drying beds, hydraulic fill and piping at Shelter Island opposite Washington Ave., $400,000. E. D. Rightmire, 530 Guarantee Trust Bldg., Atlantic City, engr. Noted Feb. 12.

O., Cleveland—Aug. 28, by City, concrete culvert in Nine Mile Creek from St. Clair Ave. to East 140th St. To exceed $75,000. R. Hoffmann, City Hall, engr.

O., Columbus—Sept. 8, by R. S. McPeak, serv. dir., constructing Olentangy-Scioto Intercepting Sewer, 60 x 25 x 23 ft., 33 x 16 x 23 ft., 38 x 20 x 26 ft. and 87 x 24 x 22 ft. rein.-con. regulator chambers, 14,400 cu.yd. excav., 3,100 cu.yd. concrete, 380,000 lb. reinforcing steel, 44,000 lb. c.i. and steel. $150,000.

O., Columbus—Sept. 15, by R. S. McPeak, serv. dir., Alum Creek Stand-by Tank, 208 x 119 ft., 15 ft. high, concrete covered, Main St. and Alum Creek. $226,000. R. H. Simpson, City Hall, engr.

O., Findlay—Sept. 15, by City, intercepting sewers, sewage treatment works. H. P. Jones & Co., Toledo Trust Bldg., Toledo, engrs. adv. E. N.-R. Aug. 27. Noted Mar. 12.

CONTRACTS AWARDED

Calif., Los Angeles—See "Streets and Roads."

Conn., West Hartford—Town, storm sewers to Louis Petrossi, 530 Wethersfield Ave., Hartford, $18,583; sanitary sewers, to Nicola Casciano, 20 Lilly Rd., $14,990.

Ill., Aurora—Bd. Trustees Aurora Sanitary Dist., 5 mi. 8- to 30-in. sewers, to Martin & Hall, Weldon, $68,025. Noted June 4.

Minn., Minneapolis—City Council, intercepting sewers connected with proposed new sewage treatment plant, day labor. Est. $400,000. **Maturity in November or December.** N. W. Elsberg, city engr.

Mo., St. Louis—Bd. P. Serv., City Hall, to Martin & Reilly, 7227 Lindell Blvd., 2,995 ft. 8- to 21-in. vitr. clay sewers in Rock Creek Dist., 19 and Public Outlet, $5,326; Warne Avenue Sewer 2, incl. 680 ft. 12 and 15-in. vitr. clay pipe, $1,378; Baden Sewer Dist. 8, 2,705 ft. 8- to 18-in. vitr. clay pipe, $7,650; Baden Sewer Dist. 9, 2,525 ft. 8- to 18-in. vitr. clay pipe, $3,562. Grand total $17,916.

N. J., Hawthorne—Bd. Comm., Boro Hall, sanitary sewerage system, in Sect. "D," to LoProta Constr. Co., South Main St., Lodi, $25,953.

N. Y., St. George—J. A. Lynch, pres. Richmond Boro, Boro Hall, sanitary sewer in Rhett Ave., to Fiorin & DeStefano, $21,588. Noted Aug. 6.

O., Cincinnati—Hamilton Co., Sewer 68 (Millcreek Interceptor, Schedule "B"), 11,801 ft. 42 in. rein.-con. and 827 ft. 8- to 24-in. vitr. clay pipe, to E. G. Connelly, 2nd Natl. Bank Bldg., $88,154. Est. $154,247.

O., Cleveland—City, 1,631 ft. 5 ft. 9 in. vitr. sewer in East 65th St. and Ashland Rd., to A. L. Connelly Co., 1900 Euclid Bldg., $111.

See proposal advertising on page 67

LEADITE

Trade Mark Registered U.S. Pat. Office

LEADITE *must* give satisfaction—

—otherwise, it would not have withstood the exacting requirements of Water Main construction for more than a quarter century,—and otherwise it would be impossible for us to say that:—

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Saves at least 75%

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Sewers (Continued)

828; 2,025 ft. 7 ft. brick block sewer in West 133rd Pl., West 134th St., Cooley and Lorain Aves., to Manson Co., 1134 East 74th St., $47,714.

Ont., Waterloo—Extending sewage disposal plant, 7,500 ft. outfall sewer main, 500 ft. tunnelling, to Cleary Dean and Nicoli, 1307 Highland Ave., Windsor, $15,951, altering and constructing addition to present plant, to Ball Bros., 33 King St. E., Kitchener, $17,817; concrete pipe, to J. Schultz, 64 Kent Ave., Kitchener, $11,501; clarifier and sludge pump, to Dorr Co., 330 Bay St., Toronto, $11,500 and $1,135 respectively. Grand total $57,904. Noted May 20.

WASTE DISPOSAL

CONTRACTS AWARDED

O., Lakewood (br. Cleveland)—City, additional incinerator unit, to Pittsburgh-Des-Moines Steel Co., Neville Island, Pittsburgh, Pa. $26,600.

BRIDGES

PROPOSED WORK

Calif., Long Beach—City Councils of Long Beach and Signal Hill, and Bd. Comrs. Los Angeles Co., bridge over tracks Pacific Electric R.R., on Orange Ave. and Hill St. $140,000. H. A. Adams City Hall, Long Beach, engr.

Calif., Sacramento—Bd. Comrs. Sacramento Co., bridge over American River at Fairoaks Blvd. $75,000. C. Deterding, Jr., co. engr.

La., New Orleans—City Council preliminary plans 800 ft. approaches to existing bridge across Industrial Canal at Florida Ave., incl. creosoted pile trestle supporting rein.-con. deck with I-beams. $70,000.

O., Bedford—State, O. W. Merrell, dir. Hys., Columbus, rein.-con. bridge and 2 approaches, Northfield Rd. $1,200,000. J. O. McWilliams, Western Reserve Bldg., Cleveland, div. engr.

Pa., Sewickley—Bd. Comrs. Allegheny Co., Court House, Pittsburgh, straightening approaches to Sewickley Bridge. $104,000. V. R. Covell, County Bldg., Pittsburgh, engr.

Wis., Milwaukee—City Council bids in September 3,926 ft. viaduct, 76 ft. wide, 60 ft. roadway, 8 ft. sidewalks, north 35th St. $1,250,000. D. McKeith, Milwaukee, comr. City Council will award 6,630 tons steel to contractors in Milwaukee, at cost.

Canada—Province of Quebec and Dominion of Canada, J. L. Francoeur, minister P. Wks., Parliament Bldgs., Quebec, plans by Provincial Dpt. Wks. and forwarded for approval to Federal Govt., Ottawa, for bridge over St. Lawrence River, from St. Gregoire to Ste. Petronille on Orleans Islands. $2,000,000.

Quebec — Provincial Dpt. P. Wks., Govt. Bldg., Quebec, 5span, 1,932 ft. concrete, steel bridge over St. Francois River between St. Francois du Lac and Pierreville.

Que., Chicoutimi—Dpt. P. Wks., Govt. Bldg., Quebec, J. L. Francoeur, minister P. Wks., soon takes bids bridge over Ste Anne River.

Que., Laprairie—Municipality soon takes bids bridge over Riviere La Tortue, Eng. Dpt. P. Wks., Quebec, engrs.

BIDS ASKED

Iowa—Sept. 1, by State Hy. Comn., Ames, three 40 x 24 ft. span, four 16 x 24 ft. span, and one 40 x 24 ft. I-beam bridges, 7 culverts, extensions, Rd. 48 B-760, Cass Co.—four 17 x 20 ft. span wood approaches, rebuilding seven 17 x 20 ft. span wood bridge, Rd. 55 between Green Island and Belleville, B-698 Jackson Co. —48 culverts, extensions, Rd. 48 near Red Oak, B-729, Montgomery Co.—adding 20 ft. slab span to present bridge, Rd. 32 near Oakland, B-577, Pottawattamie Co. C. R. Jones, aud.

Ia., Atlantic—Sept. 2, at office Auditor Cass Co., two 32 x 20 ft. span and two 24 x 20 ft. span I-beam bridges, one 70 x 20 ft. and one 80 x 20 ft. pony truss bridges, one 140 x 20 ft. and one 122 x 16 ft. high truss bridge, all on treated timber piling, also repairing 122 x 16 ft. truss bridge. Address County Engineer or Auditor.

Maine—Sept. 2, by State Hy. Dpt., Augusta, Flood Bridge over Flood Brook, Topsfield—Marsh Bridge over Marshall Brook, Southwest Harbor and Tremont—Jock Stream Bridge, Monmouth—Canal Bridge, Madison—Bartlett Bridge over Bartlett Stream, Lyman—Main St. Bridge over Meguntiecook River, Camden—Webb River Bridge, Dixfield and Mexico—Franklin St. Bridge over Kenduskeag Stream, Bangor.

Mass., Great Barrington—Sept. 1, by Dpt. P. Wks., Boston, A. W. Dean, engr., 115 ft. span steel pony truss bridge with 423 ft. bituminous macadam approaches.

New Jersey—Sept. 14, by State Hy. Comn., Trenton, bridges Route 2, Sect. 6, Fairview Ave., Paramus, Bergen Co., and Route 38, Sect. 2, Burlington Co. adv. E. N.-R. Aug. 27.

West Virginia—See "Streets and Roads."

Wis., Milwaukee—Sept. 9, by Dpt. P. Wks., City Hall, substructure for 3,415 ft. steel, deck girder bridge on timber piles, 60 ft. wide, 8 ft. sidewalks, total length incl. approaches will be 3,936 ft., also asphalt on rein.-con. sub-slab paving roadway, concrete paving sidewalks, for Milwaukee Co., D. McKeith, comr.

CONTRACTS AWARDED

Idaho—See "Streets and Roads."

Indiana and Kentucky—State Hy Comn., Indianapolis, bridge over Ohio River, from Evansville, Ind., to Henderson, Ky., Contr. 6, 2 substructures (41-A-876 and 41-A-877) each incl. five 40 ft. spans, solid, counterfort wall type abutments, rein.-con. deck girder superstructure, rein.-con. abutments and bents on timber piles, 4,277 cu.yd. concrete, 38,640 lin.ft. untreated timber piling, 546,280 lb. reinforcing steel, U. S. Rd. 41, near city limits of Evansville, Ind., to Globe Constr. Co., 2307 West Frank St., Evansville, Ind., $97,044. Noted July 9.

Iowa—State Hy. Comn., Ames, two 90 x 24 ft. plate girder and four 36 x 24 ft. I-beam approach span bridge over Illinois Central R.R. in Ackley, Hardin Co., to Weldon Bros., Iowa Falls, $26,910—140 x 20 ft. high truss bridge with five 50 x 20 ft. I-beam approach spans, near Ramsey, Marion Co., to C. A. Holvik, Mason City, $27,287—60 culverts, extensions, Marion Co., to Forgie & Groth, Sioux Center, $23,189—40 x 20 ft. I-beam approach span to high truss bridge, Mills Co., to Wickham Bridge Co., 1905 West Bway., Council Bluffs, $2,246. Grand total $79,632. Noted Aug. 13.

Neb., Columbus—City Council, federal and state bridge, incl. steel pile and steel girders, concrete substructure, near here, to Gilmore Constr. Co., Sunderland Bldg., Omaha, $84,000.

Neb., Omaha—State Hy. Dpt., Lincoln, 26 span 800 ft. span steel, timber pile bridge, at Fort Creek, Sarpy Co., near here, to Peter Kiewit's Sons, 1024 Omaha Natl. Bank Bldg. $100,000.

New Jersey—Joint Bd. City Comrs., Asbury Park and Ocean Grove, City Hall, Asbury Park, 2 steel, timber, concrete bridges over Wesley Lake, to Tuller Constr. Co., 95 Monmouth St., Red Bank, $33,710. Noted July 7.

N. J., Paterson — Bd. Freeholders Passaic Co., Court House, steel beam bridge, Ringwood Ave., Ringwood, to A. Vandermade, Planten Ave., Prospect Park. Est. $25,000. Noted July 30.

New York—A. O. Smith, hy. supt. at office Bd. Supervrs., Suffolk Co., Riverhead, substructure Shelter Island-Sag Harbor Bridges, near Sag Harbor and Shelter Island-Greenport Bridge, near Greenport, to Booth & Flinn, 1842 Forbes St., Pittsburgh, Pa., $889,615. Noted Aug. 19.

Quebec—See "Streets and Roads."

Que., Sorel—Provincial Dpt. P. Wks., Quebec, superstructure for bridge over Richilieu River, to Dominion Bridge Co., 1111 Beaver Hall Hill, Montreal, $318,000 approaches, to Church Ross & Co. Ltd., 1440 St. Catherine St. W., $196,041. Noted Oct. 24.

STREETS AND ROADS

BIDS ASKED

Calif., Los Angeles—Bd. P. Wks., City Hall, rejected bids, Aug. 12, grading, curbing, guttering, sidewalks, 6 in. concrete paving 240,000 sq.ft. 112th St. and Bellhaven Imprvt. Dist. Noted Aug. 14.

Calif., Los Angeles — City Council, bids in September improving streets in Baird Avenue and Valerio Street Imprvt. Dist. To exceed $25,000. J. J. Jessup, 222 North Hoover St., engr.

Calif., Redondo Beach—Sept. 3, by City Council, grading, curbing sidewalks, 6 in. asphaltic concrete paving 377,000 sq.ft. Elena St. et al.

Calif., Santa Cruz—H. Miller, city clk., taking bids oil surfacing 729,300 sq.ft. San Lorenzo Dr.

Connecticut—Aug. 31, by J. A. Macdonald, state hy. comr., Hartford, bituminous macadam, loose and surface treated gravel paving, bridging gravel surfacing 144,237 ft. hys. in Beacon Falls, Milford, Brookfield, Fairfield, Glastonbury, Lebanon, Litchfield, Madison, Saybrook, Sherman, Sprague, Vernon; adv. E. N.-R. Aug. 27.

Conn., West Haven—Town taking bids (selected list of bidders), rein.-con. paving 11,980 sq.yd. and bituminous macadam paving 8,300 sq.yd. Gilbert, Kelsey and Admiral Sts. $25,000 or more. Address Town Engineer, Town Hall.

Iowa—Sept. 1, by State Hy. Comn., Ames, grading, drainage structures, paving 0.35 mi. U. S. Rd. 218, F-58 east of Van Horn, Benton Co.—0.495 mi. Rd. 57 in Cedar Falls, F-317 Black Hawk Co.—0.275 mi. Rd. 60, at Ft. Dodge, P-644-B Boone Co.—0.322 mi. P. S. Rd. 65 West of Hubbard, P-642-B Hardin Co.—0.337 mi. U. S. Rd. 32 in Brooklyn, F-261 Poweshiek Co.—grading, drainage structures $.527 mi. U. S. Rd. 169, North of Winterset, Madison Co.—gravel surfacing 11 mi. U. S. Rd. 55 from Guttenburg to Millville, P-586—0.63 mi. Rd. 13, from Delaware Co. line north, P-358, both Clayton Co.—0.6 mi. Rd. 10 east of Rd. 13, P-236 DE—0.61 mi. Rd. 113 in Hopkinton, F-249-D, both Delaware Co.—8.4 mi. Roads 134 and 34 west of Plattsmouth Bridge, P-636 Mills Co. C. R. Jones, aud.

Ia., Osage—Sept. 2, at office Auditor Mitchell Co., gravel surfacing, incidental work 7 mi. local roads. Address county engineer or auditor.

Kansas—Sept. 10, by State Hy. Comn., Court House, Olathe. **(K.P. means Kansas Project)** light type surfacing 13 mi. U. S. Hy. 50, K.P. 7474 and K.P. 44—K.P. 7473 Johnson Co. —5.3 mi. U. S. Hy. 73-W, K.P. 7475, Atchison Co.—3.2 mi. K.P. 29—K.P. 7476 Riley Co.—9 mi. K.P. 11-K.P. 7477, K.P. 11-K.P. 7478 and K.P.11-K.P. 7479 Waubansee and Lyon Counties. W. V. Buck, Topeka, hy. engr.

Maine—Sept. 2, by State Hy. Dpt., Augusta, graveling 2.68 mi. hy. Parkman—2.49 mi. hy., Waterboro—bituminous macadam paving 0.76 mi. hy., Solon.

Maryland—Sept. 1, by State Roads Comn., Baltimore, concrete shoulders on 0.9 mi. Contr. S-51-111, Somerset Co. G. C. Uhl, chn.; adv. E. N.-R. Aug. 27.

Massachusetts—Sept. 1, by Dpt. P. Wks., Boston, A. W. Dean, engr., bituminous macadam paving 7,170 ft. hy. in Marblehead—185 ft. Bridgewater—rein.-con. paving 4,053 ft., Melrose.

Nevada—Sept. 2, by State Hy. Comn., Carson City, oil processing 11.01 mi.-hy. from point 10 mi. southeast of Las Vegas to Boulder City, incl., 284,094 gal. asphaltic fuel oil, 11.01 mi. mix with crushed rock or gravel, rebuilding, finishing shoulders, Clark Co. S. C. Durkee, hy. engr.

New Hampshire—Sept. 3, by State Hy. Dpt., Concord, 3 in. on 5 in. crushed gravel paving 4,532 cu.yd. Dartmouth College Rd., Cheshire Co., $40,000. 6,368 cu.yd. Catamount Rd., Pittsfield, $33,000.

New York—Sept. 8, at office Westchester Co. Park Comn., 72 West Pondfield Rd., Bronxville, grading, drainage, 4.04 mi. Saw Mill River Parkway from King St., Chappaqua to West St., Mt. Kisco, Contr. 362. J. Downer, ch. engr.; adv. E. N.-R. Aug. 27.

New York—Sept. 9, by A. W. Brandt, comr. hys., Albany, grading, structures, Grand Central Parkway, S. 2, Pt. 1, incl. grade separation 168th St. and S. 2, Pt. 2-A, grade separation Utopia Parkway. J. C. Darcy, 116 West Main St., Babylon, dist. engr.; adv. E. N.-R. Aug. 27.

New York—Sept. 15, by A. W. Brandt, comr. hys., Albany, constructing hys., bridges, in Lewis, Nassau, Saratoga and Washington Counties, reconstructing hys., bridges in Allegany, Chenango, Dutchess, Greene, Madison, Oneida and Tioga Counties; adv. E. N.-R. Aug. 27.

N. Y., Mamaroneck—Sept. 3, Bd. Town Bd. at office W. R. Marvin, Jr., town clk., grading, regulating, draining bituminous on broken stone surfacing 5,000 sq.yd. Sect. "A" Chatsworth Ave. and 9,000 sq.yd. Sect. B Rockinstone Ave., Contrs. M. and N. A. J. Foote, Hillside Arcade, Larchmont, civil engr.; adv. E. N.-R. Aug. 27.

N. Y., Yorktown—Sept. 10, at office Westchester Co. Park Comn., 72 West Pondfield Rd., Bronxville, grading, concrete paving 9,100 cu.yd. Bronx Parkway Extension from Crompound Rd. overcrossing to Crompound Rd., near Stoney St. J. Downer, ch. engr. adv.; E. N.-R. Aug. 27.

O., Cleveland—Sept. 1, by Comrs. Cuyahoga Co., paving St. Clair Ave. from East 55th St. to East 72nd St. $86,000. F. Williams, Court House, engr.

Pennsylvania—Sept. 11, by State Hy. Dept., Harrisburg, improving 6 mi. roads in Allegheny, Armstrong, Cameron, Centre, Fayette, McKean, Montgomery, Northampton and Venango Counties. S. S. Lewis, secy.; adv. E. N.-R. Aug. 27.

Utah, Springville—Sept. 2, by City Council, widening present concrete pavement 14 ft. on Main St. from 1st North to 4th South Sts. $42,242. Caldwell & Richards, Templeton Bldg., Salt Lake City, engrs.

Wash., Seattle—Sept. 8, by Bd. Comrs. King Co., clearing, grubbing 2,500 ft. guard rail, grading, drainage structures, gravel surfacing 2.75 mi. West Snoqualmie Valley Rd. $25,000. T. D. Hunt, Seattle, engr.

West Virginia—Sept. 1, by State Road Comn., Charleston, grading, drainage structures 2.8 mi. Rock Creek Rd., Project 3529, Boone Co.—10 mi. Gap Mills-Sweet Springs Rd., Project 3462-B, Monroe Co.—grading, drainage structures, shale surfacing 4.08 mi. Market-Gilmer Co. line Rd., Project 3404-C, Doddridge Co'—8.6 mi. Wardensville-Lehew Rd., Project 3489, Hampshire Co.—7 mi. Patterson-Alaska Rd., Project 3492-B, Mineral Co.—interaco on stone surfacing 0.4 mi. Louisburg Rd., Route 60, Project 2023, Greenbrier Co.—grading, drainage structures, stone base surfacing 0.2 mi. approaches to Caldwell Bridge, Project 2023, Greenbrier Co.—concrete surfacing 0.2 mi. Weirton Overhead, Project 175-A, Hancock Co.—surface treating 8.5 mi. Point Pleasant-Leon Rd., Projects 3242, 3237 and part 3250, Mason Co.—6 mi. Horsepen-Justice Rd., Projects 3345 and 3347, Mingo Co. —8.5 mi. Island Creek-Horsepen Rd., Project 3120, Mingo Co., and Project 3271, Logan Co. Sinks Bridge, concrete substructure with 140 ft. span steel through pass superstructure, Project 3442-B, Hardy Co. — Little Sandy Creek Bridge, 80 ft. span concrete arch, Project 3380, Preston Co. G. E. White, secy.

Ont., Hamilton—See "Contracts Awarded."

Quebec—See "Contracts Awarded."

CONTRACTS AWARDED

Calif., Los Angeles—Los Angeles Co., grading, curbing sidewalks, 6-7-9 in. concrete paving 370,000 sq.ft. Covina Blvd., to J. L. McClain, 3452 West Slauson Ave., $104,275. Noted Aug. 6.

Calif., Los Angeles—Bd. P. Wks., City Hall, grading, concrete and asphaltic concrete paving 148,000 cu.yd. North Spring St., et al. to M. Miller, 208 West 2nd St. $97,755. Noted Apr. 16.

Calif., Los Angeles—Bd. P. Wks., City Hall, grading, storm and sanitary sewers, 8 in. asphaltic concrete paving 195,000 sq.ft. Soto St. between Hunting Dr. and Alhambra Ave., to G. H. Oswald, 366 East 58th St., $46,134. Est. $57,736.

Calif., Los Angeles—Bd. P. Wks., City Hall, improving Silver Lake Blvd., between Glendale Blvd. and Armstrong St., to Tryon & Brain, 416 California Bldg., $168,591. Est. $194,178.

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Streets and Roads (Continued)

Calif., Los Angeles—Bd. P. Wks., City Hall, grading, curbing, guttering, sewers, sidewalks, water service connections, asphaltic concrete surfacing Anaheim St., to Griffith Co., 502 Los Angeles Railway Bldg., $111,338. Est. $122,466.

Colorado—State Hy. Dpt., Denver, paving 4.5 mi. Greenhorn-Pueblo Rd. Hy. 1, Pueblo Co., to New Mexico Constr. Co., 4080 Galapago St., Denver, $154,509 culvert on Hy. 4, near Gunnison-Montrose Line, Montrose Co., to Hinman Bros. Constr. Co., Denver, $8,456.

Idaho—State Hy. Comn., Salt Lake City, grading drainage structures, surfacing 4.165 mi. Gooding-Fairfield Hy., incl. 35 ft. span timber bridge, Comas Co., to W. Devlin, Mountain Home, $20,063; 159 ft. span concrete bridge over Aberdeen and Peoples Canal, Bingham Co., to Utah Constr. Co., Ogden, Utah, $13,083.

Idaho, Shoshone—Gooding Co., grading drainage structures, surfacing 9.559 mi. Gooding-Fairfield Hy., to Idaho Constr. Co., Boise, $43,753.

Ill., Fenton—Bd. Comrs. Franklin Co., 4 in. gravel paving 2.014 mi. State Route 14, Sect. 2-MFT., 18 ft. with 6 ft. earth shoulders, to Simpson & Feurer, Marion, $21,399.

Ill., Galesburg—Clerk Knox Co., grading, culverts, gravel surfacing Sect. N-MFT., State Aid Route 19, to Rocho Bros., Peoria, $21,311; gravel surfacing 4 mi. Maquon-Rapatee Rd., incl. 8,044 tons gravel, to J. L. Duran Constr. Co., Toulon, at $1.10 per ton. Noted Aug. 13.

Iowa—State Hy. Comn., Ames, to J. A. Dunkel, Webster City, grading, 0.31 mi. road in Hardin Co. $4,362—to G. Longerbone, 1511 13th St., Des Moines, 12.854 mi. Marion Co., $58,455—to J. Schumacher, Bancroft, gravel surfacing 4 mi., Butler Co., $2,747; 3 mi. P-688, $635, 6.5 mi. P-669 $1,914, both Floyd Co.—to C. A. Emery, Coon Rapids, 6 mi. Crawford Co. $4,942—to Sargent Bros., 1615 1st St., Des Moines, 13.5 mi. Decatur Co., $20,660, Divs. 1 and 2, P-779 Ringgold Co. $23,639—to Lyman-Richey Sand & Gravel Co., 712 Bankers Reserve Life Insurance Bldg., Omaha, Neb., 12.8 mi. Fremont Co. 8,114—to Kibbey & Foulke, Carlisle, Div. 3, Ringgold Co. $21,119—to Anderson and Empire, Marshalltown, grading, drainage structures, paving 0.701 mi. Hardin Co. $14,614—to C. R. Yegge, Boone, 0.093 mi. Tama Co. $2,498. Grand total $163,599. Noted Aug. 13.

Kentucky—State Hy. Dpt., Frankfort, grading, drainage structures, using corrugated metal pipe, 8.091 mi. Columbia-Albany Rd., Adair Co. and 4.627 mi. Liberty-Lebanon Rd., Casey Co., to Wilmore Constr. Co., Wilmore, $38,693 and $61,594 respectively —grading, drainage structures using 1st class rein.-con. pipe 3.683 mi. Shelbyville-La Grange Rd., Shelby Co.—to Southeastern Constr. Co., Eminence, $13,927—grading, drainage structures, using 1st class pipe, traffic bound limestone surfacing 2.102 mi. Scottsville-Bowling Green Rd., Allen Co., to Campbell & Co., Bowling Green, $22,453. Grand total $136,667. Noted Aug. 6.

Massachusetts—Dpt. P. Wks., Boston, A. W. Dean, engr., bituminous macadam paving 16,968 ft. hy., Egremont, to Bertolini Bros., Chester, $12,316—7,000 ft. Rockland, to Smith Constr. Co., Fall River, $23,161—graveling and bituminous macadam paving 5,350 ft. Holbrook, to Arute Bros., New Britain, Conn., $12,678 — gravel and bituminous macadam paving, incl. rein.-con. bridge in Topsfield, to Frank Orlando Co., 43 Sea View Ave., Boston, $6,024. Grand total $184,179. Noted Aug. 6.

Massachusetts—Dpt. P. Wks., State House, Boston, A. W. Dean engr., to Perini & Ampolini, 242 Waverly St., Framingham, gravel and bituminous macadam paving 5,800 ft. Plainville, $8,718 bituminous macadam paving, 4,850 ft. Sherborn, $24,740; 4,975 ft. Attleboro, $30,123; 3,500 ft. Holliston, $21,326. Grand total $84,907. Noted Aug. 13.

Mass., Boston—City, concrete walks, grading, at Castle Island, South Boston, to A. A. Doyle Co., 44 Perkins St., Jamaica Plain. Est. $25,000.

Mo., St. Louis—Bd. P. Serv., City Hall, grading, drainage structures 24,100 cu.yd. Eyler Ave., to F. Weber, Jr., 4634 Bates St., $6,782—6,545 cu.yd. Wilson Ave., to Carlo Motor Serv. Co., 4226 Olive St., $4,514—asphalt paving 4,104 sq.yd. McCausland Ave. and 1,580 sq.yd. Eveline St., to Asphalt Paving Co. of St. Louis, 1328 Sublette Ave., $25,648 and $11,300 respectively—12,245 sq.yd. Finney Ave. from Grand Blvd. to Sarah St., to Crean & Scott Constr. Co., 1242 Sublette Ave., $76,690—1,660 sq.yd. Dellenberger St. to Trinidad Asphalt Mfg. Co., 600 South Theresa Ave., $10,316—8 in. vibrolithic paving 4,810 sq.yd. Finney Ave. from Sarah St. to Pendleton Ave., to Stiers Bros. Constr. Co., 2944 Magazine St., $21,649—4,845 sq.yd. Finney Ave. from Pendleton to Taylor Aves., to Ansbro & Maguire, 4833 Parker Ave., $18,508—warrenite bituthic paving 1,054 sq.yd. Grand Blvd., to Granite Bituminous Paving Co., Railway Exch. Bldg., $5,360—concrete paving with macadam shoulders 10,240 sq.yd. Hampton Ave., to Skrainka Constr. Co., Security Bldg., $23,534. Grand total $203,301. Noted July 16.

Neb., Sidney—Concrete paving 6 blocks Main Ct., 36 ft., to Yant Constr. Co., 1146 Omaha Natl. Bank Bldg., Omaha, $26,000.

Nevada—State Hy. Dpt., Carson City, oil processing 16.86 mi. from point 4 mi. east of Silver Zone to Wendover, Elko Co., to A. D. Drumm, Jr., Fallon, $29,624. Est. $35,538.

New Hampshire—State Hy. Dpt., Concord, 7 in. one course rein.-con. on 8 in. gravel paving 30,357 sq.yd. Daniel Webster Hy.,

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Merrimack Co., to Ames D. Bridges Sons, Inc., Hazardville, Conn., $102,394. Est. $160,000. Noted Aug. 6.

N. J., Cliffside Park—Bd. Boro Council, Boro Hall, grading bituminous macadam paving DeSoto and Shannon Pls., to R. J. Fox, 565 Gorge Rd., Grantwood. Est. $25,000. Noted July 30.

N. J., Newton—Bd. Freeholders Sussex Co., Court House, grading, gravel surfacing Mattison School House Rd., Frankford, to R. H. Bossert, 208 1st St., Newark. $25,000.

N. J., Paterson—Bd. Freeholders Passaic Co., Court House, removing ledge of rock and paving Midvale Rd., to Union Building & Constr. Co., 150 Prospect St., Passaic. Est. $25,000. Noted July 23.

New York and New Jersey — See "Unclassified."

N. Y., Long Island City—G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., to W. P. McDonald, 304 Shore Rd., Douglas Manor, paving Continental Ave., $31,897, asphalt paving Nassau Blvd, $22,597—to Meehan Paving & Constr. Co., Inc., Laurel Mill Blvd., Rowan St., $8,725; 31st Rd. $7,048; Catalpa Ave. $9,417; 45th St. $11,432; grading, curbing, bituminous concrete paving 46th Ave. $19,381—to Carbloc Co., Stagg St., Brooklyn, asphalt paving 37th St. $16,620; Queens Blvd. $31,825—to Borough Asphalt Paving Co., 1301 Metropolitan Ave., Brooklyn, 62nd St. $11,336—to Pomonok Asphalt Paving Co., 130th St. $11,760; Cooper Ave. $52,834—to Palmo Constr. Corp., Woodhaven Blvd., Ozone Park, regulating 122nd St. $11,369—to Slattery Contg. Co., Inc., 7201 51st St., bituminous concrete surfacing Yellowstone Rd. $12,076—to Charles Bennet Impvt. Co., Inc., 465 Fennimore St., Brooklyn, 58th St. $8,356—to H. J. Mullin Contg. Co., Inc., 139-39 Jamaica Ave., Jamaica, bituminous macadam paving 201st St. $22,866; regulating Carlisle St. $7,491; 164th St. $5,765—to Peace Bros., Inc., 34-15th Lawrence St., Flushing, 73rd St. $10,552. Grand total $313,347. Noted July 23.

N. Y., Long Island City—G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., regulating 82nd and Bell Sts., to Gamaglio Eng. Co., 1441 Waterbury Lane, Brooklyn, $7,602 and $8,762 respectively.

N. Y., St. George—J. A. Lynch, pres. Richmond Boro, Boro Hall, bituminous concrete paving Hillside Terrace and grading Bedell Ave., to Vanbro Constr. Co., 24 Elizabeth St., Port Richmond, $13,814. Noted Aug. 6.

N. Y., Syracuse—City Council, to Rago Bros., Inc., Union Bldg., repaving Temple St. $14,916, Sabine St. $9,067; paving Dorchester Ave. and Wheaton Rd. $13,966; Columbus Ave. $7,040. Grand total $44,989.

O., Lisbon—Columbiana Co., widening, brick on concrete paving Clark Ave. in Wellsville, to Matthew-Grein Sons, Youngstown, $56,333. Noted July 23.

Oklahoma—State Hy. Dpt., Oklahoma City, concrete slab surfacing 5.01 mi. State Hy. 19, 20 ft., Pontotoc Co., to Gibson & Gibson, Pauls Valley, $59,846. Est. $65,000.

Pa., Greensburg—Paving Sidney, Welty, Weaver and Brandon Sts., to T. Pantalone, Greensburg. Est. $45,000.

Pa., Phila.—Bureau Hys. Dpt. P. Wks., City Hall Annex, A. Murdock, dir., grading Edmund St. from Benner to Comly Sts. and Walker St. from Deveraux to Robbins Sts. and Fillmore St. from Tackawanna to Jackson Sts., to M. Masse, 3936 North Reese St. $973—asphalt repaving 18th St. (portion occupied by tracks) from Ridge to Montgomery Sts., to Union Paving Co., Broad and Stiles Sts. $13,121—curbing and footway work, 1st and 2nd Hy. Dists., to S. Aversa, 731 Watkins St. $1,150—43rd and 6th Hy. Dists., to M. Coachio, 2631 South 16th St. $994—5th and 7th Hy. Dists., to M. Madden & Sons, 1222 East Venango St. $421—intersection of Church Lane, Limekiln Pike and 17th St. and intersection of Lincoln Dr., Emlen and Ellet Sts., to J. Zecca, 6441 Vine St. $421 and $681 respectively. Grand total $18,630. Noted Aug. 14.

Rhode Island—State Bd. P. Roads, Providence, bituminous concrete paving 25,000 sq.yd. Newport Ave., Pawtucket, Contr. 3111, to Joseph McCormick, East Providence, $47,976. Noted Aug. 6.

South Dakota — State Hy. Comn., Pierre, to A. J. Jarvis, Sioux Falls, grading, drainage structures 12.418 mi. State Hy. 34, Lake Co. $25,873; 9.395 mi. State Hy. 54, McPherson Co. $15,041—to Dowd Bros., Clark, 12.986 mi. McCook Co. $32,641—to State Eng. Co., Rapid City, oil surfacing 12.771 mi. U. S. Hy. 12, Brown Co. $17,511—to Summit Constr. Co., Summit, 13.305 mi. U. S. Hy. 14, Brookings and Kingsbury Counties $13,193—to Larson-Erling Co., Sioux Falls, 10.024 mi. U. S. Hy. 12, Brown Co. $47,163; 13.373 mi. State Hy. 11, Moody and Brookings Counties $38,128—to J. L. Healey, Manchester, gravel surfacing 3.997 mi. State Hy. 18, Dewey Co. $5,317—to Wiley-Lien Constr. Co., Summit, 14.952 mi. State Hy. 18, Perkins Co. $26,339 — to Martin Joyce, Brandon, 13.921 mi. State Hy. 22, Hand Co., $11,206—to W. E. Bartholow & Son, Huron, 5.086 mi. Turner Co. $5,561; 20 mi. Douglas Co. $15,984; 20.014 mi. Bradley-Crandall Rd., $10,294; 6 mi. Melham Rd., $4,578, both Clark Co.—18.25 mi. U. S. Hy. 212 $11,921, 6.113 mi. U. S. Hy. 81, $2,867, both Coddington Co. —to Thesian Bros., Osmand, Neb., 17.444 mi. McCook Co. $5,845—to S. S. Roberts, Flandreau, 16.574 mi. Grant Co., $7,477—to Northwestern Eng. Co., Rapid City, 9.675 mi. Washabough Co., $9,313—to W. H. Pringle, Pierre, 14 guard rail projects, incl. 58,410 ft. guard rail, $17,666. Grand total $232,928.

Tex., Freeport—City, I. Goldbert, mayor, E. C. King, secy., curbing, storm sewers, necessary appurtenances, one course rein.-con. paving 38,000 sq.yd., to Broussard-Warfield Co., Beaumont, $76,105. Noted Aug. 6.

Wisconsin—State Hy. Comn. and Hy. Comn. Grant and Iowa Counties, Lancaster, grading Option A, 8.025 mi. Dodgeville-Lone Rock Rd., Iowa Co., to P. W. Ryan Sons, Janesville, $39,916—0.417 mi. Platteville-Dickeysville Rd., Project 9420, to Interstate Constr. Co., Madison $7,116—mine tailing surfacing Platteville-Dickeysville Rd., to Wilkinson & Slack, Mifflin, Wis., $555—Albrecht Bridge on Dodgeville-Lone Rock Rd., to E. Kramer, Plain, $10,897—Carthew Bridge on Platteville-Dickeysville Rd., to W. Granberg, Blanchardville, $6,838. Grand total, $65,322. Noted July 9.

Wis., Viroqua—Vernon Co. Hy., C. Huff, comr., crushed stone surfacing 17,000 cu.yd. roads in Sterling, to O. Sander, Mt. Horeb, $19,380—shale base course surfacing 13,000 cu.yd., to Brockman Bros., Sparta, $4,460—crushed stone surfacing 31,000 cu.yd. in Jefferson, to P. Dempsey & Son, Fennimore, Wis., $35,960.

Ontario—R. M. Smith, deputy minister Hys., Dpt. Hys., Toronto, concrete paving 1 mi. approaches to Belleville Bay Bridge and Trenton overhead bridge, Contr. 31-44, to Kilmer & Barber, Harbor Bldg., Toronto—5.5 mi. Galt southerly, Contr. 31-45, to McArthur Eng. & Constr. Co., 15 Douglas St., Guelph—2 mi. Douglas Ave., from Windsor city limits to South of M.C.R. subway, Contr. 31-46, to Cadwell Sand & Gravel Co., 228 Sandwich St. W., Windsor—5.5 mi. Ontario-York Co. line to Greenwood on No. 7 Hy., Contr. 31-47, to Curran & Briggs, Manning Chambers, Toronto—asphaltic macadam paving 5.5 mi. Paris Northerly, Contr. 31-49, to Standard Paving Co., Harbor Bldg., Toronto—concrete work on Orchardville Bridge, Contr. 31-51, to W. E. Mackie Box 672, Mildmay—Blenheim Overhead Bridge, Contr. 31-52, to Hadleys Ltd., 47 Wellington St. W., Chatham. Est. $500,000. Noted July 16.

Ont., Hamilton—City Council, grading, widening Mountain Rd., Wentworth Ave. and 4 streets, day labor. Est. $135,000. W. L. McFaul, City Hall, engr.

Ont., Toronto—Asphalt paving Sect. A, University Ave., to Constructing & Paving Co., Confederation Life Bldg., $19,427—Sect. B, same avenue, to Law Constr. Co. Ltd., 225 Sterling Rd., $18,387—Sect. C, same avenue to Kilmer & Barker, Harbour Bldg., $18,663—Sect. D, same avenue, to Rayner Constr. Co., 159 Bay St., $44,182. Grand total $100,859.

Ont., Toronto—York Twp. asphalt paving sections Rockcliffe Blvd., Batavia and Ronald Aves., to Godson Contg. Co. Ltd., 203 Richmond St. W.; bithulithic paving sections Folkes Ave., to Warren Bituminous Paving Co. Ltd., 74 University Ave. Est. $50,000.

Quebec—Provincial Govt. Dpt. Rds. & Hys., Parliament Bldgs., Quebec, J. L. Boulanger, supt., clearing and grubbing 20 mi. road between St. Hyacinthe and St. Hubert, day labor, $2,500,000. Contract for concrete to be awarded.

Quebec—Provincial Dpt. P. Wks., Quebec, approaches to Francois du Lac Bridge on Levis-St. Lambert hy. along south shore of St. Lawrence River, to Canadian Vickers Ltd., Maisonneuve St., Montreal, $122,980.

EXCAVATION, DRAINAGE, IRRIGATION, LEVEES, RIVER AND HARBOR

PROPOSED WORK

Ala., Mobile—H. T. Hartwell, Gulfport, Miss., 10 mi. sea-wall.

Calif., Santa Barbara—Bd. Comrs. Santa Barbara Co. surveys diverting Mission Creek through Arroyo Burro to Ocean to eliminate flood menace to congested area of city, incl. constructing diversion works with open channels, tunnels through Samarkand Hills, $650,000. E. B. Brown, city engr.

Ky., Louisville—Jefferson Co. dredging 2,000 ft. channel south of Beargrass Creek, from City-County boundary south of Eastern Parkway to Newburg Rd., incl. 200,000 cu.yd. excav., $30,000. M. Deane, County Court House, engr.

Mich., Pigeon—Pigeon River Drainage Dist., W. J. Steadman, co. drain comr., surveys drainage district. $500,000. Francis Eng. Co., Saginaw, engrs.

Mississippi—Bear Creek Drainage Dist. of Humphreys, LeFlore and Sunflower Counties, will not take bids 9,000,000 cu.yd. drainage ditches, 1,000,000 cu.yd. earthwork in levees. Project indefinitely postponed. C. E. Miller, Belzoni, engr. Noted Feb. 19.

Okla., Purcell—Walnut Creek D. D. 3, bids about October, 8 mi. open ditches, incl. 300,000 cu.yd. excav. $40,000. Milliken & Whiteneck, Majestic Bldg., Oklahoma City, engrs.

Ont., London—City, W. P. Near, engr., extending breakwater in West London. $25,000.

BIDS ASKED

Calif., Los Angeles—Bd. Supervs. Los Angeles Co. taking bids river protection work on Los Angeles River for Los Angeles Flood Control Dist., incl. constructing levees and granite riprap from Orange St. north to Pacific Electric R.R. $80,000; from Washington St. in Belle-

Excavation, Drainage, Irrigation, Levees (Cont.)

flower north to Southern Pacific R.R. $145,000; rein.-con. levees from Dayton Ave. to Fletcher Dr. $150,000; jetty protection work to protect cooling system of Los Angeles Gas & Electricity's generating plant at Alamitos Bay, $170,000. Bids later on Almitos Bay Outlet, incl. levees, jetties, 2 pipe trestle bridges, also rein.-con. bridge estimated at $140,000. Total est. $750,000. E. C. Eaton, Hall of Records Bldg., engrs.

Ill., East St. Louis—Sept. 17, by East Side Levee & Sanitary Dist., 217 Metropolitan Bldg., furnishing, replacing 25,000 sq.yd. revetment, on levee of Project 7, incl. 2,000 cu.yd. excav. for footings and grading levee. E. F. Harper, c/o owner, ch. engr.

La., Baton Rouge—Sept. 1, by Police Jury East Baton Rouge Parish, constructing 2.75 mi. Comite-Bowman Canal, 5th Ward, incl. 40,000 cu.yd. excav. J. J. Mundinger, Court House, engr.

Ont., Oshawa — Sept. 2, by N. Desjardins, secy. Dpt. P. Wks., Ottawa, extending harbor wall. $75,000. Noted July 9.

CONTRACTS AWARDED

Calif., Los Angeles—Los Angeles Harbor Dpt., 405 Branch, City Hall, San Pedro, 2,125 ft. rein.-con. sheet pile mole for fish harbor extension, incl. dredge fill, 83,400 lin.ft. various sizes and lengths sheet piling, to Merritt-Chapman & Scott Corp. and Pan-Pacific Constr. Co., Berth 140, Wilmington, $448,860. Noted July 30.

La., Shreveport—Caddo Parish Levee Bd., for Thompson, Long Point, Clycerine Bayou and Eagle Lake Levees, to New Constr. Co., Shreveport.

Mass., Barnstable—A. A. Jones, Main St., Centerville, concrete and rubble stone wall, Main St., to Tallman Bros., Wianno Ave., Centerville. Est. $25,000.

Mass., Rockport—Dpt. P. Wks., A. W. Dean, engr., State House, Boston, seawall and bulkhead, to Geo. N. Nicoll Co., 161 Milk St., Boston, $39,213. Noted July 23.

Mass., Scituate—Dpt. P. Wks., A. W. Dean, engr., State House, Boston, seawall, jetties, Sand Hills and Cedar Point, to Crowley & Downey, 17 Shirley St., Quincy, $14,923. Est. $75,000. Noted July 16 Daily.

B. C., Kelowna—South East Kelowna Dist. constructing flumes and irrigation work, to Interior Contg. Co. Ltd., Penticton, $45,000.

Ont., Toronto—J. G. Langton, genl. mgr. Toronto Harbour Comrs., Harbour Bldg., dredging in Toronto Harbour, to Kilmer, Gibson & Van Nostrand Ltd., Fleet St. and Spadina Ave. Est. $50,000. Noted July 16 Daily.

Bond Elections

Coming Bond Elections

Water Supply, inc. Pumping Equipment, Intake, Mains, etc.—Lexington, Mich. $25,000. Francis Engr. Co., Saginaw, Engrs.

Waterworks Impvts., Inc. Settling Basin, Pumping Station, Tank, Distribution Mains, etc.—Waverly, Mo., Aug. 31. $45,000.

Breakwater to enclose 5,400,000 sq.ft. protected water area—Santa Monica, Calif.

Power Plant and Distribution System—Le Mars, Iowa, Sept. 3. $325,000.

Power Plant—Piqua, O., November. $810,000. Burns and McDonnell Eng. Co., Kansas City, Mo., Engrs.

Power and Light Plant and System — Plainview, Tex. $100,000.

Hospital Improvements and Equipment—Ohio, State, November. $7,500,000.

Bonds Voted

Waterworks Improvements — Canyon, Tex., $18,000.

Waterworks Improvements, incl. Pipe Line to Dam at Fairybrook—Fernie, B. C., $40,000.

Bonds Defeated

Straightening Buttress of Hodges Dam and Acquisition of Right of Way for Reservoir Purposes—San Diego, Calif., $460,000.

FEDERAL GOVERNMENT

PROPOSED WORK

Mo., St. Louis—FEDERAL BUILDING—Treas. Dpt., at office Sup. Archt., probably takes bids in early fall 10 story (165 ft. high), basement, 213 ft. 9 in. x 257 ft., rein.-con., stone, Market and 12th Sts. Maurin, Russel & Crowell, Chemical Bldg., archts. Noted May 14.

Mass., Williamstown—POST OFFICE—Treas. Dpt., 1 story, basement, brick, stone post office. $95,000.

Tenn., Chattanooga—POST OFFICE—Treas. Dpt., at office Sup. Archt., approved preliminary plans 4 story, 142 x 246 ft. post office, 9th St. and Georgia Ave. To exceed $1,000,000. **Maturity late in winter.** R. H. Hunt, 1st Natl. Bank Bldg., archt. Shreve, Lamb & Harmon, 11 East 44th St., New York, assoc. archts. Noted June 18.

Tenn., Memphis—HOSPITAL—Treas. Dpt. at office Sup. Archt., plans by Regan & Weller, Memphis, 3 story addition to U. S. Marine Hospital, California Ave. $175,000.

Tex., Ft. Sam Houston (sta. San Antonio)—HOSPITAL—Con. Q.M., 10 story hospital in Argonne Heights, near here. $2,000,000. Plans abandoned addition and remodeling present building here.

Vt., Norton Mills—INSPECTION BUILDING—Treas. Dpt., sketches 1 story, basement, brick, stone inspection building Canadian Border, West Rd. $375,000.

Ont., Ottawa—OFFICE—Dpt. State Bureau of Foreign Buildings, Wash., D. C., soon takes bids general contract consulate office building. $300,000.

BIDS ASKED

Ala., Montgomery—RADIO BUILDING and UTILITIES—Sept. 16, at office Constr. Q.M., Maxwell Field, radio building and utilities at Maxwell Field; adv. E. N.-R. Aug. 27.

Ariz., Grand Canyon—ROAD—Sept. 1, by C. H. Sweetser, dist. engr. Pub. Rds., at office Park Superintendent, seal coat on existing oil treated crushed rock surfacing 18.993 mi. Grand Canyon-Desert View Rd. in Grand Canyon Natl. Park, Coconino Co., incl. 230 tons asphaltic oil, 1,600 cu.yd. screenings for seal coat.

D. C., Wash.—PAVING—Sept. 9, at office Executive Officer Memorial Bridge Comm., Navy Bldg., cold bituminous concrete or small granite block (Durax type) paving 14,500 sq.yd. Arlington Memorial Bridge roadway and Boundary Channel Bridge adv. E. N.-R. Aug. 27.

D. C., Wash.—RESERVOIR—Aug. 31, by Treas. Dpt. at office Sup. Archt. 3 mg. concrete reservoir in Ft. Stanton Park.

Florida—LEVEE—Sept. 15, at office U. S. Eng., P. O. Box 45, Jacksonville, constructing 35,000 lin.ft. levee and navigation channel, incl. removing navigation channel, placing in levee 2,177,000 cu.yd. material dragline section or 3,066,000 cu.yd. hydraulic section, incl. drainage structures between Disston Island Drainage Dist. Pumping House 1, near Moore Haven and extending towards Clewiston; adv. E. N.-R. Aug. 27.

Fla., Miami—POST OFFICE, COURT HOUSE, etc.—Sept. 15, by Supervising Architect, Treas. Dpt., United States Post Office, Court House, Customs House, other buildings. $2,080,000. Noted Aug. 20.

Idaho, Boise—HOSPITAL—Vet. Bu., bids about Sept. 20, infirmary addition. $250,000. Noted Mar. 26.

Ind., Terre Haute—POST OFFICE—Treas. Dpt. bids about Nov. 1, rein.-con., limestone, marble, ornamental iron, brick, 7th and Cherry Sts. $600,000. Miller & Yeager, 819 Ohio St., archts. Noted Apr. 30.

Me., Eustis—INSPECTION STATION—Sept. 8, by Treas. Dpt., inspection station. $59,100.

N. Y., New York—FREIGHT ELEVATOR—Spec. 6569—Sept. 9, by Yards and Docks, Navy Dpt., electric freight elevator; adv. E. N.-R. Aug. 27.

R. I., Newport—BRIDGE CRANE—Spec. 6583—Sept. 2, by Yards and Docks, Navy Dpt., two-ton electric traveling bridge crane with hoisting and operating equipment at Naval Torpedo Station (Goat Island) adv. E. N.-R. Aug. 27.

R. I., Pawtucket—POST OFFICE—Sept. 8, by Treas. Dpt., 2 story, basement, brick, Montgomery and Hume Sts. $200,000. J. A. Wetmore, c/o owner, archt.

R. I., Pawtucket—ELEVATOR, etc.—Sept. 8, by Treas. Dpt. 1 freight elevator and 1 dumbwaiter in post office.

Tex., Fort Sam Houston—TELEPHONE CONDUIT SYSTEM—Sept. 18, at office Signal Officer Eighth Corps Area, underground telephone conduit system.

Vt., Derby Line—INSPECTION STATION—Sept. 9, by Treas. Dpt., at office superv. archt., 1 story, brick inspection station. $93,000. Noted July 16.

CONTRACTS AWARDED

Ark., Brinkley—POST OFFICE—Treas. Dpt., at office Sup. Archt., general contract brick, concrete, stone, to J. Barnes, Logansport, Ind., $48,845. Noted July 30.

Calif., Mare Island (sta. Vallejo) — IMPROVEMENT BUILDINGS—Yards & Docks, Navy Dpt., Improvement Buildings 34, 40, 42 and 48 for pipe and copper shop (steel building frame), at Navy Yard, to Golden Gate Iron Wks., 1541 Howard St., San Francisco, $18,696.

Florida — BEACONS — Dpt. Commerce, Div. Purchases & Sales, electric airway beacons on Madison-Birmingham Sect., to Dixie Electric Co., 4044 North 20th St., Birmingham, Ala., $12,968; on Jackson-Florence Sect., to Hennington Eng. Co., 326 Union State Bank Bldg., Omaha, Neb., $23,251; on New Orleans-Atlantic Sect., to R. H. Bouligny, Inc., 27 West 1st St., Charlotte, N. C., $43,634. Grand total $79,852. Noted May 14.

Idaho, Boise—ELEVATOR—Treas. Dpt. at office Sup. Archt., passenger elevator in federal building, to Otis Elevator Co., 810 18th St. N.W., Wash., D. C. $9,911. Noted May 7.

La., New Orleans—EARTHWORK—U. S. Eng., 570,000 cu.yd. earthwork on south bank Red River, Poland Levee and Colonge Bend Levee, to H. Kenyon Dredging Co., 3603 McKinney St., Houston, Tex., $50,559; 900,000 cu.yd. Atchafalaya Front Levee, Australia Point Levee, to Lewis Chambers Constr. Co., Canal Bank Bldg., $115,000.

La., Shreveport—ROOFING—Office of G. E. Lamb, con. Q.M., Barksdale Field, steel deck roof, insulator built-up and asbestos protective and metal roof for warehouse, garage and maintenance buildings, to W. M. Werner, Shreveport, $11,000; filling work in lake area near Kirby headquarters, to Red River Constr. Co., 2404 Fairfield Ave. Noted July 30.

Mass., Winthrop—POST OFFICE—Treas. Dpt., 1 story, basement, brick, stone, plain found., Metcalf Sq., to M. Argentieri, 557 Atwells Ave., Providence, R. I. Est. $60,000.

Missouri—REVETMENT—U. S. Eng., 428 Custom House, St. Louis, 3,500 to 6,000 ft. standard revetment in Missouri River at Howard Bend 37.5 mi. above mouth of river, to Woods Brothers Constr. Co., Lincoln, Neb., $54,050. Noted July 16.

Wash., Cle Elum—DAM—Dpt. Interior, rock fill Cle Elum Dam on Yakima Reclamation Project, to Winston Bros., 1470 Northwestern Bank Bldg., Minneapolis, Minn., $1,311,534; clearing site, to Siems-Helmers, 1014 Guardian Bldg., St. Paul, Minn., $291,600. Noted June 4. Ill. Est. $4,000,000.

Wash., Seattle—PAVING—Yards & Docks, Navy Dpt., paving at Naval Air Station, to C. L. Creelman, 1079 25th St. N., $15,200.

Wyo., Sheridan—ROADS—Vet. Bu., constructing, resurfacing roads around U. S. Veterans' Hospital, to N. McDonald Constr. Co., 1311 Syndicate Trust Bldg., St. Louis, Mo., $36,700.

T. H., Pearl Harbor—CONCRETE FLOOR—Yards & Docks, Navy Dpt., concrete floor at Naval Air Station, to L. N. Gratz, Honolulu, T. H., $33,837.

RAILWAYS

BIDS ASKED

Delaware, etc.—See "Contracts Awarded."

CONTRACTS AWARDED

Delaware, etc. — Pennsylvania R.R., T. J. Skillman, Broad St. Sta., Phila., Pa., underground conduit and signal system for electrification from Wilmington, Del., to Wash., D. C., day labor.

Texas—R. G. Gowdy, ch. engr. Fort Worth & Denver Northern R.R., subsidiary Colorado & Southern Ry., Denver, Colo., constructing 110 mi. line from Childress to Pampa, to Hamilton & Gleason, Tramway Bldg., Denver, Colo., and Roberts Brothers, 130 North Wells St., Chicago, Ill. Est. $4,000,000.

GRADE CROSSINGS

PROPOSED WORK

Calif., Newport Beach—City Council overhead crossing at The Arches to segregate vehicular and railway traffic on Newport Beach-Costa Mesa Rd. where road crosses state hy. To exceed $200,000.

N. Y., Mount Vernon—New York, New Haven & Hartford R.R. Co., New Haven, Conn., R. L. Pearson, ch. engr., and State of New York, Albany, soon take bids general contract reconstructing grade separation at Lincoln Ave. $52,000. Noted June 12.

BIDS ASKED

Md., Baltimore—Aug. 31, by Pennsylvania R.R., T. J. Skillman, ch. engr., Broad St. Sta., Phila., Pa., undergrade bridges over Gay St., Preston and Wolfe Sts., Washington and Biddle Sts., relocating Ellsworth St. and constructing new Biddle St. Station and platforms.

Tex., Belton—See "Contracts Awarded."

CONTRACTS AWARDED

Tex., Belton—Texas Central Power & Light Co., white way for City. $25,000. Owner builds. Noted Apr. 2.

Wash., Seattle—Northern Pacific Ry. Co., St. Paul, A. Blum, ch. engr., substructure 186 ft. steel bascule bridge with horizontal clearance of 150 ft., movable leaf of bascule span 186 ft., tower span 56 ft., counterweight has internal steel trusses weighing 1,500,000 lb., founds will be on three concrete piers with 18 x 35 ft. base, 60 ft. high, 300 ft. steel girder span approaches and 15 spans of timber trestle with 225 ft. total length over West Waterway, to General Constr. Co., Colman Bldg. Est. $350,000.

DAMS

PROPOSED WORK

Calif., Los Angeles — Los Angeles Co. Flood Control Dist. plans to build 3 dams in San Gabriel Canyon and water spreading grounds at mouth of canyon. Supreme Court decision has made available approximately $21,000,000 that remains from money voted for high dam in canyon. E. C. Easton, Hall of Records, Bldg., engr. Noted Jan. 8.

CONTRACTS AWARDED

Que., St. Michel des Saints—Shawinigan Water & Power, Shawinigan Falls, dam. $25,000. Owner builds.

PIERS AND WHARVES

BIDS ASKED

R. I., Providence—WHARF and PIER SHED—Sept. 2, by State of Rhode Island, Harbor Comm., State House, wharf, pier shed, at Pier L, Allen Ave. To exceed $25,000. Perry Sarle, 95 Fountain St., engr. Noted Aug. 20.

Ont., Kingsville—PIER—Sept. 1, by N. Desjardins, secy. Dpt. P. Wks., Ottawa, repairing East Pier. $28,000. Noted July 31.

AIRPORTS

PROPOSED WORK

Ga., Atlanta—American Airways, Inc., c/o C. R. Smith, Candler Field, hangar, waiting rooms, shops, $75,000. B. A. Slater, c/o American Airways, Inc., 1404 Main St., Dallas, Tex., engr.

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Airports (Continued)

Ga., Atlanta—City, c/o J. Berman, chn. Aviation Com. Council, plans by Tucker & Howell, 1711 Rhodes Haverty Bldg., 2 story, tower, 60 x 125 ft., stucco, tile, stone, steel administration building, Candler Field, $50,000.

Ill., Chicago—American Airways, Inc., Lambert St. Louis Field, Universal Division, Robertson, Mo., soon takes bids rein.-con., brick, steel hangar and lean-to. Hoener, Baum & Froese, 3605 Laclede Ave., St. Louis, Mo., archts.

POWER AND LIGHTING

PROPOSED WORK

Calif., Oakland — City Council, ornamental lighting system, incl. underground system on East 14th St. between 22nd Ave. and High St. $60,000. W. N. Frickstad, city engr.

Minn., Grand Rapids—See "Bridges."

Okla., Bretton—Franchise election Sept. 17, natural gas system to Western Service Corp., Braniff Bldg., Oklahoma City. E. R. Ernsberger, pres. $40,000. Private plans.

Okla., Vinita — Franchise election Sept. 1, natural gas system to Ladow-Stryker Co., Fredonia, Kan.

Tex., San Antonio—T. J. Dixon, et al., c/o Willow Springs Golf Club, lighting system for night golf course, incl. 743 globes, 1,000 watt each. $30,000. Private plans.

BIDS ASKED

Mo., St. Louis—See "Contracts Awarded."

CONTRACTS AWARDED

Mo., St. Louis—Missouri Industrial Gas Co., 1017 Olive St., will lay 4 in. natural gas main on Bremen Ave. from 2 nd St. westwardly 3,035 ft. to 21st St. eastwardly on Mullanphy St. about 751 ft., own forces.

PARKS AND SPORTS

PROPOSED WORK

N. H., New Ipswich — Appleton Academy, sketches 1 story, basement, 60 x 85 ft., brick gymnasium, campus grounds. $25,000 or more. H. L. Meacham Associates, 120 Front St., Worcester, Mass., engrs.

Ont., Sandwich—City plans by R. M. Thompson, Imperial Bank Bldg., 60 x 90 ft. municipal swimming pool. $40,000.

CONTRACTS AWARDED

N. Y., Long Island City—Park Bd., W. R. Herrick, pres., Park Dpt., Arsenal Bldg., Central Park, New York, erecting, completing field house, Rainey Park, Queens Boro, to G. Tark & Son, 39-62 51st St., Queens. $9,495. Noted July 30.

N. Y., New York—Park Bd., W. R. Herrick, pres., Park Dpt., Arsenal Bldg., Central Park, constructing walks, curbing, retaining wall, along westerly side Boston Rd., Bronx Park South and Bronx Park East, to Frank Mascali & Sons, 645 East Tremont Ave., $13,176. Noted July 30.

Tex., Beaumont—City, park improvements, incl. paving, storm sewers, sidewalks, to Scott Shambaugh, Cleve F. Myers and Broussard-Warfield Co., Beaumont. $25,000. Noted Apr. 23.

Wyo., Casper—Bd. Educ., c/o J. H. Arbuckle, clk., gymnasium, to Rognstad & Olsen, Casper, $93,500.

HEATING AND VENTILATING

BIDS ASKED

Miss., Jackson—See "Hospitals."

N. Y., New York—Sept. 3, by W. C. Martin, archt. and supt. School Buildings, Flatbush Avenue extension and Concord St., Brooklyn, heating, ventilating apparatus, plumbing, drainage for Samuel Gompers Industrial High School for Boys, Tinton and Wales Aves., East 145th and East 147th Sts., for Bd. Educ., 500 Park Ave.

CONTRACTS AWARDED

N. Y., Oswego—State Dpt. Educ., Education Bldg., Albany, heating work, boilers in State Normal School, to Hennessey Bros., 106 East 1st St. $13,950. Noted July 30.

UNCLASSIFIED

PROPOSED WORK

N. Y., Newtown — COKE POCKETS — New York & Queens Gas Co., 1 Irving Pl., New York, coke pockets on Flushing River at Northern Blvd. $40,000. J. Hunter, c/o owner, engr.

N. Y., New York—ALTERING—A. L. Berman, 1133 Bway., bids early in September, altering apartments, incl. incinerator, steam heating plant, plumbing, 25 West 106th St. $25,000. A. J. Simberg, 1133 Bway., archt. Noted Aug. 19.

N. Y., New York—ELEVATOR, etc.—J. B. Snook, archt., 52 Vesey St., did not award contract altering elevator, equipment in loft and salesroom, 1631 Bway., for E. E. Wendel Estate, 175 Bway. Project in abeyance. Noted July 30.

N. Y., New York—GAS EXHAUST HOUSE, etc.—Consolidated Gas Co., Irving Pl., gas exhaust house, to exceed $15,000; gas conveyor, to exceed $30,000, at Hunts Point Ave. and Bronx River. Private plans.

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N. Y., New York—TELEVISION and BROADCASTING STATION—National Broadcasting Co., 5th Ave. and 55th St., television and broadcasting station, Empire State Building, 34th St. and 5th Ave. To exceed $200,000. **Maturity in October.** Noted Aug. 6.

Tex., Dallas—CEMETERY—W. W. Caruth, Caruth Hill, developing tract (Northwest Hy. between Airline and Colt Rds.) into Hillcrest Memorial Cemetery. $1,500,000.

Tex., San Augustine—PUMPING PLANT—Texas Pipe Line Co., San Augustine and Texas Co. Bldg., Houston, reconstructing pumping plant, incl. new equipment, on oil line, recently destroyed by fire. O. Wolk, San Augustine and Houston, engr.

Que., Montreal East—FIRE ALARM SYSTEM—Town Council soon takes bids fire alarm system, $33,000. A. Adelard, pro-mayor. This corrects report in Aug. 6 issue.

Que., Portneuf Station — FIRE SYSTEM — Municipal Council, N. Marcotte, secy.-treas; fire protection system. P. Frenette, Portneuf Station, preparing plans.

BIDS ASKED

O., Cleveland—BOILER—Aug. 28, by City, furnishing, erecting boiler steel, boiler setting, breeching and breeching insulation at Warrensville Farm, F. H. Cover, 502 City Hall, engr.

CONTRACTS AWARDED

New York and New Jersey—TOLL BUILDINGS—Port of New York Authority, 80-90 8th Ave., New York, constructing toll buildings for Kill van Kull Bridge between Port Richmond, N. Y., and Bayonne, N. J., to Auf der Heide Contg. Co., 443 16th St., West New York, N. J., $41,490.

N. Y., Brooklyn—BULKHEAD—Dpt. Docks, M. Cosgrove, comr., Docks, Pier "A," Battery Pl., New York., Contr. 2017, constructing steel sheet pile bulkhead at Columbia St., Erie Basin, to A. N. Spooner & Sons, Pier 11, North River, New York. $102,379.

N. Y., Kingston—FOUNDATION PILING—Adjutant General Div. Military & Naval Affairs, Executive Dpt., Capitol, Albany, foundation piling for State Armory for Field Artillery, to Wm. Parrott's Sons, 10 Henry St., Newburgh, $9,882. Noted July 30.

N. Y., New York—ELEVATOR—H. Hohauser, archt., 1431 Bway., elevator, plumbing, heating, for De France Hotel, to James McWilliams Co., 7 East 44th St., for National Club Hotels, 535 5th Ave., New York. Est. $50,000. Noted July 23.

N. B., St. John—SHEDS—Harbour Comrs., 2 sheds, to Canadian Vickers Ltd., Maisonneuve St., Montreal, Que., $150,000; 1 shed, to St. John Dry Dock Co., Ltd., St. John, N. B., $50,000.

MATERIALS

PROPOSED WORK

PIPE—**Dallas, Tex.**—City, c/o E. Goforth, soon takes bids 3,000 ft. 6 in. and 3,000 ft. 8 in. pipe sand cast class B or equal, AWWA specifications or monocast, DeLavud, McWane or equal.

BIDS ASKED

CEDAR POLES—**Redding, Calif.**—Sept. 8, by L. Engram, city clk., thirty 9 in. top 45 ft. and thirty 9 in. top 40 ft. Western Red Cedar poles, butt creosoted ½ in. guaranteed penetration.

ROAD OIL—**Iowa**—Sept. 1, by State Hy. Comn., Ames, 96,500 gal. medium and heavy road oil, f.o.b. various destinations. C. R. Jones, aud.

STEEL PIPE, etc.—**Minneapolis, Minn.**—Sept. 8, by F. S. Gram, city purch. agt., 771 lin.ft. 60 x 7/16 in. thickness, 977 lin.ft. 60 x ¼ in., 217 lin.ft. 50 x ¼ in. lock bar or 771 lin.ft. 62 x ¼ in., 977 lin.ft. 62 x 7/16 in., 217 lin.ft. 50 x 7/16 in. riveted type steel pipe, fittings, to be laid under Mississippi River. $30,000. N. W. Elsberg, city engr.

STEEL SHEETS and WHEELS—**Phila., Pa.**—Sept. 1, by C. E. Walsh, purch. agt., Pennsylvania R.R., 15 North 32nd St., steel sheets, Contr. 23—1931, steel wheels, Contr. 24—1931.

CONTRACTS AWARDED

STEEL PIPE—**Burbank, Calif.**—W. S. Patterson, city mgr., Los Angeles, 1,530 ft. 24 in. and 1,365 ft. 20 in. concrete lined steel pipe (wrappings extra) to American Concrete Pipe Co., 4636 Firestone Blvd., Southgate, $2.50 and $2.05 per ft. respectively.

STEEL PIPE, etc.—**Ontario, Calif.**—City Council, to Smith-Booth Usher Co., 1910 Santa Fe Ave., Los Angeles, 16,100 ft. 4 in. black wrought steel pipe with couplings T and C lap-welded at $39 per 100 ft.; 2,800 ft. 2 in. standard black pipe, T and C butt-welded $14.95 per 100 ft.

PIPE—**Hartford, Conn.**—Metropolitan Water Dist., C. M. Saville, eh. engr., various sized c.i. bell and spigot water pipe, to Amer. Cast Iron Pipe Co., 2930 North 16th St., Birmingham, Ala., $35,354.

ASPHALTIC JOINT FILLER, etc.—**New York, N. Y.**—S. Levy, pres. Manhattan Boro. Municipal Bldg., 600 tons asphaltic joint filler, to Standard Oil Co. of New York, 26 Bway., $7,884; 20,000 cu.yd. asphaltic sand, to Z. Mahoney, Lemoine Ave., Ft. Lee, N. J., $17,800; 2,500 cu.yd. concrete and paving sand, to Colonial Sand & Stone Co., 551 5th Ave., $4,875. Grand total $30,559. Noted Aug. 6.

EQUIPMENT

BIDS ASKED

RECARBONIZING EQUIPMENT — **Beverly Hills, Calif.**—Sept. 15, by B. J. Firminger, city clk., carbonizing equipment for water plant.

WATER METER—**Beverly Hills, Calif.**—Sept. 15, by B. J. Firminger, city clk., furnishing delivering large water meter in connection with water works.

SNOW FENCE, STEEL POSTS—**Cherokee, Ia.**—Sept. 8, at office Auditor Cherokee Co., 35,500 ft. snow fence, four thousand six hundred 6½ ft. steel posts, also moving, erecting 80 x 16 ft. high truss bridge on creosoted abutments.

ROAD OIL DISTRIBUTER—**Reno, Nev.**—Sept. 5, by Bd. Comrs. Washoe Co., 1,200 gal. BLJ road oil distributer with 4 cylinder Model K Le Roi power unit, also 1 burch spreader.

ELECTRIC ELEVATOR—**Elmira, N. Y.**—Sept. 15, by Commissioner Dpt. Correction, Albany, electric elevator hospital building; arch. E. N.-R. Aug. 27.

PLOW BLADES, LIFTING DEVICES, etc.—**New York, N. Y.**—Aug. 31, by P. J. Doolin, comr. Purchases, 1900 Municipal Bldg., furnishing, delivering plow blades, lifting devices to Dpt. Sanitation; tools, implements, tapping machine and launch parts, to Dpts. Correction, Parks-Bronx, Plant & Structures, Water Supply, Gas & Electricity and Police Dpt.

SCHOOL SUPPLIES—**New York, N. Y.**—Aug. 31, by P. Jones, supt. School Supplies, at office Bd. Educ., Park Ave. and 59th St., furnishing, delivering auto mechanics, electric wiring, sign painting, sheet metal, draft printing, instrument making, art metal, foundry, physics supplies direct to High, Trade and Vocational Schools.

SHOP EQUIPMENT, **New York, N. Y.**—Aug. 28, by R. W. Rodman, supt. Plant Operation of Bd. Educ. of New York City, 131 Livingston St., Brooklyn, furnishing, moving, installing shop equipment, ventilation in P. S. 74, Manhattan Boro, and James Monroe High School, Bronx Boro.

FOREIGN

Brazil—Central do Brazil R.R., Rio de Janeiro, and Federal Govt. of Brazil, Rio de Janeiro, plan electrifying railroad in Sao Paulo State.

Commercial Buildings

RESIDENTIAL

BIDS ASKED

Me., Rumford—Rumford Building Assn., c/o Coombs & Harriman, archts., 11 Lisbon St., Lewiston, taking bids 3 story, basement, mezzanine, brick, steel hotel, plain found., Hartford and Congress Sts. $150,000.

N. J., Kearny (sta. Arlington)—See "Contracts Awarded."

N. Y., Long Island City — See "Contracts Awarded."

N. Y., New York—See "Contracts Awarded."

N. Y., St. Albans—See "Contracts Awarded."

CONTRACTS AWARDED

N. J., Kearny (sta. Arlington) — Verona Constr. Co., 60 Park Pl., Newark, 3 story, basement, 95 x 115 ft., brick, steel, plain found., Rose St. and Belgrove Dr., separate contracts, $150,000. Harris & Sohn, 17 Mechanic St., Newark, archts.

N. Y., Long Island City — Hefgold Realty Corp., 1 East 44th St., New York, 6 story, 116 x 150 ft., 46th St. and 43rd Ave., separate contracts, $300,000. B. Brunstien, 163 18th St., Jamaica Ave., archt.

N. Y., Long Island City—Morris-Morris Corp., Chatham-Phoenix Bldg., M. Schwartz, pres., 6 story, 90 x 125 ft., 41st St. and 3rd Ave., separate contracts $200,000. B. Braunstein, 163-18 Jamaica Ave., Jamaica, archt.

N. Y., Long Island City—Nicholas Kenneth Holding Corp., 110 West 47th St., New York, 6 story, 83 x 130 ft., 49th and Roosevelt Aves., separate contracts, $150,000. V. Schiller, 30-40 41st St., Astoria, archt.

N. Y., Long Island City—Nicholas Kenneth Holding Corp., 110 West 47th St., New York, 6 story, 83 x 100 ft., 49th St. and Foster Ave., separate contracts, $150,000. I. Wolf, c/o owner, archt.

N. Y., New York—Rohro Realty Corp., 2174 Barnes Ave., 6 story, 75 x 150 ft., Holland and Brady Aves., separate contracts, $220,000. R. E. Golden, 2419 Webster Ave., archt.

N. Y., St. Albans—Bellatre St. Albans Realty Corp., 89-39 163rd St., Jamaica, 2 story apartment, 168th St. and Foch Blvd., separate contracts, $150,000. A. P. Sorice, 166-05 88th Ave., Jamaica, archt.

CLUBS

PROPOSED WORK

N. J., Hohokus—Owner, c/o P. J. Jossier, archt., 240 Broad Ave., Palisades Park, revised sketches 2 story, basement, brick, steel golf club, plain found., $150,000. Noted Apr. 23.

N. J., Orange—Women's Club of Orange, Mrs. F. W. Tooker, chn. building com., 16 South Maple Ave., East Orange, revised plans by D.

Clubs (Continued)

E. Ward, 1 Madison Ave., New York. 2 story, basement, brick, steel club, plain found., 349 South Center St. $150,000. **Maturity in November.** Noted June 18.

HOSPITALS

PROPOSED WORK

Mass., Fall River — Union Hospital, J. Smithies, supt., 338 Prospect St., soon takes bids 4 story, basement, brick, steel nurses' home, plain found., Prospect St. $200,000. E. I. Marvel, 209 Bedford St., archt. Noted June 11.

Ohio—State plans election in November, $7,500,000, for buildings as follows: $200,000, new cottages, equipment, $150,000 fireproofing, repairing State Hospital, $225,000 new cottages, cold storage plant, $100,000 fireproofing, repairing Institute for Feeble Minded, Columbus; $450,000 cottages, fireproofing, repairing, $25,000 new wells, mains extensions, Athens State Hospital, Athens; $150,000 fireproofing, repairing Cleveland State Hospital $685,000 cottages, equipment, offices, $85,000, additions and repairs to power plant, $30,000 industrial buildings at Hawthorndon Farm, Cleveland; $360,000 cottages, equipment; $40,000 cold storage plant industrial additions, $30,000 boilers, stokers, $100,000 fireproofing, repairs, Dayton State Hospital, Dayton $140,000, improvements and additions Lima State Hospital, Lima; cottages, kitchen, bakery equipment, remodeling, fireproofing Longview State Hospital, Cincinnati; $250,000 cottages at Longview Hospital State Farm, Otterbein; $100,000, additions, fireproofing, repairing, $40,000, waterworks improvements, $40,000, boilers, stokers, Massillon State Hospital, Massillon; $360,000 cottages, additions, fireproofing, repairing, $20,000 engines, generators at Toledo State Hospital, Toledo; $275,000 cottages, fireproofing, repairing, $50,000 power plant equipment, $35,000 dairy barn at Ohio State Hospital for Epileptics, Gallipolis; $213,000 additions, fireproofing, repairing Institute for Feeble Minded, Orient; $1,200,000 cottages, equipment, dining room, general construction, $125,000 cold storage, kitchen, bakery $125,000 laundry and equipment, at Institute for Feeble Minded, Apple Creek; $50,000 isolation hospital, repairs, Ohio State Sanitarium, Mt. Vernon; $300,000, hospital, fireproofing, repairing, $15,000 new watermains, Ohio Soldiers and Sailors Home, Sandusky; $10,000 repairing Madison Home, Madison; $150,000 cottages, equipment, fireproofing, repairing, $25,000 sewage disposal plant, Boys Industrial School, Lancaster $175,000, cottages, fireproofing, repairing Girls Industrial School, Delaware; $100,000 additions, equipment, $80,000 land, London Prison Farm, London $30,000, improvements, equipment, Grafton State Farm, Grafton; $30,000 power plant, $30,000 fireproofing, repairing Ohio Reformatory for Women, Marysville; $40,000 power plant, $155,000 additions fireproofing, equipment, $80,000 land, Ohio State Reformatory, Mansfield.

BIDS ASKED

Miss., Jackson—Sept. 4, by State Hospital Removal Impvt. & Landsale Comn., New Capitol Bldg., general contract, also wiring, plumbing and heating systems (1) Negro Group 4, incl. 5 buildings, heating and plumbing systems (2) Negro Group 2, incl. 9 buildings (3) steam distribution for White Group (4) kitchen equipment for White Group (5) tunnel system for Negro Group. N. W. Overstreet, Standard Life Bld., archt.

CONTRACTS AWARDED

Vt., Waterbury—Vermont State Hospital for Insane, E. A. Stanley, supt., 3 story, 60 x 142 ft., brick, steel ward, to Loukes & Clark Corp., 6 Ernest St., Wallingford, Conn. Est. $150,000. Noted July 23.

CHURCHES

PROPOSED WORK

Mass., Northampton — St. Valentine Polish Natl. Church, L. A. Dabrowski, pastor, 200 King St., plans by H. J. Tessier, 220 Dwight St., Springfield, and soon takes bids 1 story, basement, brick, stone, plain found., King St. $150,000.

N. J., East Orange—Trinity Congregational Church, 26 Harrison St., altering and constructing 2 story, basement, brick, steel church addition, Harrison St. $150,000. Project in abeyance. Bids in. W. F. Bower, 437 Main St., archt. Noted July 30.

N. Y., Brooklyn—Parish of Immaculate Heart of Mary, 119 East 4th St., bids after Sept. 7, general contract 75x94 ft. church, Fort Hamilton Parkway and East 4th St. $200,000. H. V. Murphy, 208 Livingston St., archt.

Que., Quebec—P. Levesque, archt., 115 St. John St., soon lets contract 3 story, 45 x 125 ft., stone addition to monastery, for Hotel Dieu du Precieux Sang, Charlevoix St. $400,000.

SCHOOLS

PROPOSED WORK

Calif., San Francisco—Roman Catholic Archbishop, 1100 Franklin St., rejected bids girls' school and home, incl. 4 reinf.-con buildings, Silver Ave. Project indefinitely postponed. H. A. Minton, 525 Market St., archt. Noted Aug. 6.

Calif., Vallejo—Vallejo City School Dist., E. L. Cave, secy. Bd. Educ., plans by Davis Pearce Co., Builders Bldg., Stockton, Junior and Senior High School. Election $230,000 bonds for same.

Mass., Medford (Dist. Boston)—City, A. J. Harty, City Hall, soon takes bids 2 story, basement, brick, steel school, plain found., Hervey Dist., Hutchins & French 11 Beacon St. Boston, archts. $150,000. Noted June 25.

Neb., Omaha — Holy Cross Parish, J. J. Paschang, pastor, probably take bids about Jan. 1, 2 story, basement, 88 x 115 ft., concrete brick, Bedford stone school, incl. auditorium, library, music and rest rooms. Lahr & Stransel, 1104 W.O.W. Bldg., archts.

N. J., Montclair—Bd. Educ., 22 Valley Rd., plans by Starrett & Van Vleck, 393 7th Ave., New York, and takes bids probably in September, 2 story, basement, brick, steel, plain found., Maple Ave. near Bloomfield St. $400,000.

N. Y., Middle Village—Bd. Educ., 500 Park Ave., New York, plans by W. C. Martin, Flatbush Ave. extension and Concord St., Brooklyn, 3 story, 90 x 183 ft. school, Penelope Ave. and 80th St. $585,000.

R. I., Wickford—Town of North Kingston School Bd. plans by H. A. Lewis, 75 Westminster St., Providence, 2 story, basement, 60 x 142 ft., brick, limestone, Phillip St. and Post Rd. $150,000. Architect receiving estimates on septic tanks and equipment.

BIDS ASKED

Conn., Middlebury—Sept. 4, by superintendent schools, and Haynes & Mason, archts., 280 Main St., Fitchburg, Mass., 2 story, basement, brick, stone school, plain found., Main St. $150,000.

La., Jonesboro—Jackson Parish School Bd., W. C. McClendon, secy., bids about Sept. 15, 2 story, basement, reinf.-con., brick, stone, steel and iron work, $100,000. Also plans 2 story, basement, brick, concrete school at Hodge $50,000. Noted Aug. 14.

Mass., Quincy—City, P. Building Dpt., City Hall, taking bids 2 story, brick school addition, Newbury Ave. $150,000. Hutchins & French, 11 Beacon St., Boston, archts. Noted Aug. 6.

Mass., Waltham—Sept. 2, by City Mayor's Office, City Hall, 2 story, basement, brick, stone school, plain found., Appleton Park. $150,000. Fay, Spofford & Thorndike, 44 School St., Boston, archts. Noted Aug. 27.

Minn., Marshall—Sept. 5, by Bd. Educ., H. S. Simons, clk., 3 story, basement, reinf.-con., brick, stone school, $200,000. Croft & Boerner, 1004 Marquette Ave., Minneapolis, archts.

Pa., Phila.—Sept. 1, by Bd. Educ., E. Merchant, secy., 19th and Ludlow Sts., 3 story, basement, 183 x 291 ft., reinf.-con., brick, plain found., 59th and Malvern Sts., I. T. Catharine, 19th and Ludlow Sts., archt.

Tenn., Nashville—Bd. Educ., A. E. Hill, pres., taking bids, East Nashville High School, 3 story, stone, red brick, concrete, incl. gymnasium, auditorium, also concrete stadium, Gallatin and 10th Sts., Marr & Holman, Stahlman Bldg., archts. Noted July 2.

Tex., College Station — See "Contracts Awarded."

CONTRACTS AWARDED

N. J., Hackensack—Bd. Educ., 355 State St., altering and constructing 2 story, basement, brick, steel addition to School 4, plain found., Fairmont Ave., to Ferber Constr. Co., 16 Johnson Ave., Hackensack, steel, to Hudson Structural Iron Wks., Inc., Ft. Henderson St., Jersey City, plumbing, to Zabransky Bros., 19 Picken St., Little Ferry, heating and ventilating, to B. H. Steinke, 17 Westervelt Pl., Teaneck. Est. $150,000.

N. J., Linden—Bd. Educ., St. George Ave., 3 wings each 2 story, basement, brick, steel high school, plain found., to Tri-City Constr. Co., 100 Westminster Pl., Garfield, $154,800; steel and ornamental iron, to Hudson Structural Iron Wks., Ft. Henderson St., Jersey City, $19,000; plumbing, to Jachnig & Peoples, Inc., 221 13th Ave., Newark, $10,700; heating and ventilating, to Geo. J. Tobin, 187 North Ave., Plainfield, $34,805; electrical work, to Broad Electric Co., 377 West Market St., Newark, $17,400. Grand total $236,771.

N. J., New Brunswick—Bd. Educ., general contract Senior High School, 1 and 3 story, basement, brick, steel, to Charles J. Smith Constr. Co., 262 Academy St., Trenton, $187,421; steel and iron, to United Steel & Iron Wks., Inc., New Brunswick, $22,815; plumbing, to Jachnig & Peoples, Inc., 221 13th Ave., Newark, $22,500; heating, to Burns Lane & Richardson Co., 361 Burnett St., New Brunswick, $37,678; electrical work, to DeLaPlaine Bros., 1254 Raritan Ave., Highland Park, $32,450. Grand total $302,864. Noted Aug. 20.

Tex., College Station—A. and M. College, 2 story, part basement, reinf.-con., brick chemistry building, day labor, under supervision of Bill Orth. $350,000. F. E. Giesecke, College Station, college archt. Sub-contracts will be awarded by bidding, interested dealers communicate with architect at once. Awarded contract for 70 tons structural steel, to Alamo Iron Wks., 130 Santa Clara St., San Antonio, $8,100. Noted July 9.

THEATRES

CONTRACTS AWARDED

Tex., Amarillo—J. N. Beasley & Associates, Fisk Bldg., 5 story, basement, 90 x 135 ft., and 2 story theatre and store, 9th and Polk Sts., to C. S. Lambie Co., Amarillo Bldg. Est. $232,000. Noted Aug. 6.

BANKS

BIDS ASKED

Kan., Topeka—Sept. 4, by National Bank of Topeka, C. W. McKean, pres., 14 story, 75 x 115 ft. (157 ft. high) concrete, steel, stone bank and office building, 6th St. and Kansas Ave. $500,000. T. W. Williamson & Co., 312 Farmers Natl. Bank Bldg., and M. Vitzthum & Co., 1 North La Salle St., Chicago, archts. Noted Aug. 20.

Tex., Tyler—Sept. 1, by Peoples Natl. Bank, C. S. Greer, pres., from selected group contractors, 10 story, basement, 66 x 170 ft. brick, steel bank and office, plain found. $480,000. A. C. Finn, Bankers Mortgage Bldg., Houston and Tyler, archt. Noted July 30.

OFFICES

CONTRACTS AWARDED

Ill., Chicago—Graham, Anderson, Probst & White, archts., 81 East Jackson Blvd., ornamental bronze work for office building, to General Bronze Corp., 314-19 Tenth St., Astoria, N. Y. $600,000 elevator to Otis Elevator Co., 600 West Jackson St., for Marshall Field Estate, 232 South Clark St. Noted July 23 under "Contracts Awarded."

STORES

PROPOSED WORK

N. J., Asbury Park—J. Ackerman, 101 Asbury Ave., will not build 2 story, basement, brick steel store, office. $150,000. Project abandoned. C. B. Cook, 605 Bond St., archt.

Que., Quebec City—Metropolitan Stores, Ltd., London, soon lets contract 2 story, basement, 60 x 180 ft., brick, steel, concrete department store. W. Sutherland, archt.

BIDS ASKED

N. J., Hackensack—Boundary Realty Co., S. Kraft, pres., 7 Prospect Ave., taking bids and open same about Aug. 27, general contract 3 story, basement, brick, steel store, apartment, plan found. Essex St. and Prospect Ave. $150,000. L. H. Friedland, 567 5th Ave., New York, archt. Noted Aug. 6.

PUBLIC

PROPOSED WORK

Calif., San Jose—COURT HOUSE—Santa Clara Co. sketches rebuilding courthouse recently destroyed by fire, using present brick shell, adding 1 story. $180,000. Architect not appointed. Noted June 4.

Calif., San Jose—SCIENCE—State of California plans by R. Wyckoff, Growers Bank Bldg., 3 story, basement, reinf.-con. science building. $200,000.

N. J., Maplewood—MUNICIPAL—Township Comn., Municipal Bldg., revised sketches by Guilbert & Betelle, 20 Branford St., Newark, 2 story, basement, brick, steel, plain found., Valley St. $200,000. Noted June 25.

N. J., Roselle—LIBRARY—Bd. Trustees Public Library sketches 1 story, basement, brick, steel, plain found., Chestnut St. $150,000.

BIDS ASKED

Conn., Newtown—LIBRARY—Town taking bids, C. H. Booth Memorial Library, 2 story, basement, concrete, brick, steel, Main St. $200,000. P. N. Sunderland, 248 Main St., Danbury, archt. Noted May 21.

Mass., Cambridge—COURT HOUSE—Sept. 1, by Middlesex Co., W. C. Bardwell, clm., Court House, 3 and 4 story, basement, brick, steel, stone, plain found., 3rd and Spring Sts., East Cambridge. $200,000. C. R. Greco, 11 Beacon St., Boston, archt. Noted May 21.

R. I., Newport—FIRE STATION—City, W. N. Sayer, clk., taking bids 2½ story, basement, 65 x 105 ft., brick, stone, steel, plain found., Marlboro St. $150,000. M. Trafficante, 177 Taunton Ave., East Providence, archt. Noted Aug. 6.

CONTRACTS AWARDED

Calif., San Francisco—WAR MEMORIAL and OPERA HOUSE—San Francisco War Memorial Comn., to Alta Electric Co., 638 Howard St., electrical work for opera house $178,125, for veterans' building $268,850 (motor-generator equipment for both buildings $18,500), for City and San Francisco Co. Grand total $2,966,965. Noted Aug. 6.

N. J., Jamesburg—INSTITUTIONAL—Dept. Institutions & Agencies, State Office Bldg., Trenton, three 2 story, basement, 25 x 100 ft., brick, steel buildings at State Home for Boys, to Pozzi & Felice, 227 Franklin St., Trenton, plumbing and heating, to Wm. A. Salt, 606 Boulevard, Seaside Heights. Est. $150,000.

N. Y., Long Island City—COURT HOUSE—G. U. Harvey, pres., Queens Boro, Queens Subway Bldg., constructing municipal and magistrates court house, to Tobin & McKenna, 162 Park Ave., New York. $2,966,000. Noted Aug. 6.

UNCLASSIFIED

PROPOSED WORK

Calif., Eureka—STAGE TERMINAL and HOTEL—Pickwick Co., 5th and Mission Sts., San Francisco, plans by O'Brien Bros. & Pench, 315 Montgomery St., San Francisco, 9 story, basement, 175 rooms, 100 bath, reinf.-con. To exceed $150,000.

Calif., Long Beach—MARKET and SHOPS—Long Beach Market Co., Ltd., Atlantic St. and Bway., plans by Eng. Dpt. of Owner, 2 story, basement, 190 x 360 ft., Bway. $350,000.

Que., Riviere du Loup—ORPHANAGE—Reydes Soeurs du Bon Conseil, Chicoutimi, orphanage. $200,000. Architect not appointed.

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Unclassified (Continued)

Que., Riviere du Loup — REFUGE — City, refuge home, $240,000. City set aside $25,000 and Quebec Govt. voted $135,000 for same. Sisters du Don Conseil, Chicoutimi, will handle management.

BIDS ASKED

Calif., Pomona — NEWSPAPER — Progress-Bulletin Publishing Co., bids about Sept. 1 (from selected list of contractors) 3 story, basement, 119 x 120 ft., rein.-con., art stone, steel, marble, tile, wrought iron, incl. freight and passenger elevators, 3rd and Thomas Sts. $200,000. L. Rogers, 2412 West 7th St., Los Angeles, archt. E. W. Cunningham, 1333 North Louise St., Glendale, engr. Noted Aug. 13.

Calif., San Francisco—WAR MEMORIAL and OPERA HOUSE—San Francisco War Memorial Com., taking bids metal windows, miscellaneous iron work for War Memorial Group, Civic Center, for City and San Francisco Co. Total est. $5,000,000. Noted Sept. 11, 1930.

N. Y., New York—DORMITORY—Sisters of Jean Baptiste, 184 East 76th St., will award contract about Sept. 1, from bids already submitted for dormitory, 1087 Lexington Ave. $150,000. R. J. Reiley, 12 East 41st St., archt.

CONTRACTS AWARDED

Mass., Boston—PUBLISHING and SERVICE PLANT—Christian Science Publishing Society and Christian Science Monitor, c/o C. L. Churchill, archt., 9 Newbury St., 2 and 9 story, basement, 100 x 680 ft., rein.-con., steel, granite, limestone publishing building and service plant, Back Bay Sect., to Aberthaw Co., 80 Federal St. Est. $3,000,000. Noted Apr. 23.

Pa., Pittsburgh—HOME for AGED—Little Sisters of the Poor, Mother Agatha, in charge, 1028 Benton Ave. N.S., general contract rebuilding brick home, to Duquesne Constr. Co., 5131 Cypress St. Est. $300,000-$600,000. Noted Aug. 20.

Industrial Buildings

FACTORIES AND MILLS

PROPOSED WORK

Ala., Mobile — PETROLEUM REFINING PLANT—Coastal Petroleum Co., refinery near here, $200,000. Owner receiving preliminary estimates on refining equipment, etc.

Ga., Rossville — PLANT — Peerless Woolen Mills, Rossville, soon lets contract 3 story, 100 x 300 ft., concrete, brick, steel addition. To exceed $250,000.

Ill., Harrisburg — FLOUR MILL — Woolcott Milling Co., H. Woolcott, secy., sketches rebuilding flour mill, recently destroyed by fire. $100,000.

Ill., Metropolis—SAW MILL—E. C. Artman Lumber Co. sketches rebuilding saw mill, recently destroyed by fire. $50,000.

Mass., Boston—LAUNDRY—C. Bonanno Laundry & Supply Co., 95 Albany St., soon lets contract altering and constructing 2 story, brick addition. $40,000. French & Hubbard, 210 South St., engrs.

Mo., St. Louis—PACKING PLANT—Sieloff Packing Co., 4329 Natural Bridge Ave., soon takes bids 3 story, basement, 80 x 175 ft., rein.-con., brick addition, also altering present buildings. Wedmeyer & Nelson, 824 Wainwright Bldg., and Bonnell-Tohntz Co., 1515 North Grand Blvd., assoc. archts.

N. J., Newark—REFINERY PLANT—Emile Snyder, Inc., 306 South St., rebuilding 2 story, basement, brick, steel, plain found., 298-306 South St., recently destroyed by fire. $40,000. **Maturity soon.** Architect not appointed.

Ohio—BAKERY—See "Hospitals."

Ohio—LAUNDRY—See "Hospitals."

O., Girard — LEATHER PLANT — Ohio Leather Co., soon lets contract leather plant addition. To exceed $40,000 with equipment.

O., Sandusky—FACTORY—Ohio Colprovia Co., 1276 West 3rd St., Cleveland, asphaltic paving material plant, near Wagner stone quarries. $125,000. **Maturity soon.** Private plans.

Tenn., Chattanooga — HOSIERY MILL — Davenport Hosiery Mills, 906 Garard Ave., bids after Aug. 25, general contract 100 x 250 ft. mill. $100,000. Roberts & Co., Bona Allen Bldg., Atlanta, Ga., archts.

Tex., Harlingen—PACKING PLANT—Texas Citrus Fruit Growers Mission, rein.-con., brick, North 1st St. $75,000. H. H. Ewing, Mission, engr.

Tex., Port Neches—TEXTILE MILL—Carolina Mills, c/o P. L. Hare, real estate representative, Beaumont, acquiring building site near here for textile mill plant. $500,000.

Tex., San Antonio—FERTILIZER PLANT—American Fertilizer & Chemical Wks., T. F. Hawkins, pres., San Saba, 100 tons daily capacity commercial fertilizer manufacturing plant, incl. pulverizing, manufacturing and mixing building, weighing, shipping and storage building offices, equipment, machinery, 401 North Comal St. $75,000. Private plans.

Wis., West Allis—PLANT—Allis Chalmers Mfg. Co., 5 story, 60 x 116 ft. plant and office addition. $150,000. **Maturity soon.**

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Ont., Renfrew—PACKING PLANT—Richards & Abra, 55 Metcalfe St., Ottawa, soon lets contract brick, steel, for Ottawa Valley Packing Co.

Que., St. Lambert—CREOSOTING PLANT—J. J. Seguin Co., Ltd., new creosoting plant on 65 acre site along Canadian Natl. Ry.'s main line. $200,000.

BIDS ASKED

Calif., San Francisco—PLANT and WAREHOUSE—L. P. Hobart, archt., Crocker Bldg., taking bids 1 story, 100 ft. frontage concrete, galvanized iron, Brannan St., for Vermont Marble Co., 244 Brannan St. $40,000.

N. H., Derry—SHOE FACTORY—Derry Assn., F. W. Young, Derry, taking bids altering and constructing 2 story addition. $40,000. G. G. Adams, Bay State Bldg., Lawrence, Mass., archt.

N. Y., Brooklyn—LAUNDRY—State Laundry Co., Myrtle and Nostrand Aves., taking bids general contract altering 3 story laundry, Myrtle and Nostrand Aves. I. Goldstone, 703 Lefferts Ave., archt.

N. Y., New York — PRINTING and PUBLISHING PLANT — Lockwood Greene Co., archts. and engrs., 100 East 42nd St., bids about Sept. 15, printing and publishing plant, 44 Broad St., for Dow-Jones & Co., 44 Broad St. $500,000.

Tex., Harlingen—DRY ICE PLANT—Solid Carbonic Corp., taking bids 1 story, rein.-con., brick, plain found. $750,000. Private plans.

Tex., Harlingen—GASOLINE PLANT—See "Contracts Awarded".

Que., Grandmere — PLANT — Hollands Ltd., Manchester, England, or c/o Lawson & Little, archts., Architects Bldg., Montreal, taking bids 2 story, 90 x 100 ft., steel, brick plant, Ryan & Combe, 1118 Phillips Pl., Montreal, consult. engrs.

CONTRACTS AWARDED

Calif., Stockton—FACTORY—Fraser Furnace Co., 445 South San Joaquin St., 1 story, 110 x 150 ft., brick, Scotts Ave., to F. Zinck, 2034 North Pacific Ave. $60,000, incl. equipment.

Ill., East St. Louis—FERTILIZER PLANT—Virginia Carolina Chemical Corp., Richmond, Va., general contract 4 story, 160 x 368 ft. concrete plant, also five 1 story buildings, one 20 x70 ft., one 30x60 ft., one 16x42 ft., one 18x20 ft., all frame, and other 28 x 80 ft., concrete, at Fairmount City, near here, to Austin Co., Arcade Bldg., St. Louis, Mo. and 16112 Euclid Ave., Cleveland, O. Est. $100,000. Noted Aug. 13, under "Contracts Awarded."

Ind., Anderson—FACTORY—Anderson Battery Co., general contract rein.-con., brick, steel, hollow tile, to F. Cook, Middletown, $40,000.

Mass., Everett—COKE PLANTS—New England Fuel & Transportation Co., 250 Stuart St., Boston, concrete, steel, coke screen equipment and coke storage buildings, plain founds., Beacham St., to Koppers Constr. Co., Koppers Bldg., Pittsburgh, Pa. Est. $40,000.

N. H., Durham—DAIRY—University of New Hampshire Durham, general contract 1 story, 45 x 122 ft., 25 x 55 ft., 25 x 35 ft., 30 x 120 ft., and 22 x 34 ft. brick, steel, concrete dairy buildings, to Osgood Constr. Co., 25 East Hollis St., Nashua. $39,675. Noted Aug. 6.

N. J., Bayonne—OIL REFINING PLANT—Tidewater Oil Co., Constable Hook, general contract 1 story, basement, brick, steel, plain found., to Walter E. Lumis Co., 30 Church St., New York. Est. $200,000. Noted Aug. 20.

N. J., Linden—FACTORY—Atlantic Romper Co., Inc., 50 Atlantic Ave., Elizabeth, general contract 2 story, basement, 60 x 200 ft., brick, steel, to Wilhelms Constr. Co., 119 Division St., Elizabeth. Est. $40,000. Noted Aug. 19.

N. J., Nutley—FACTORY—George LaMonte & Son, 299 Kingsland Rd., 2 and 3 story, basement, brick, steel addition, plain found., to John W. Ferguson Co., 152 Market St., Paterson. Est. $40,000. Noted July 16.

N. D., Grand Forks—NEWSPAPER PLANT—Grand Forks Herald, general contract 2 story, basement, rein.-con., brick, to Thorvaldson-Johnson Co., Grand Forks. Est. $100,000.

R. I., Bridgeton—PLANT—W. H. Prendergast Mills, 51 Madison Ave., New York, and Bridgeton, 1 story textile finishing plant addition, to Orton & Stark, 505 Old Colony Bldg., Providence. Est. exceeds $40,000.

Tex., Harlingen—GASOLINE PLANT—Pure Distributing Corp., Corpus Christi, subsidiary Pure Oil Co. 35 East Wacker Dr., Chicago, Ill., 1 story, concrete, steel, plain found., 120,000 gal. capacity, Hansen and F Sts., day labor. $40,000.

GARAGES

PROPOSED WORK

Mass., Medford—Boston Elevated Ry. Co., 31 St. James Ave., Boston, soon lets contract founds. for 1 story, 65 x 155 ft., brick, steel bus garage addition, Salem St. and Felsway W. $50,000. A. J. Blackburn, 31 St. James Ave., Boston, archt.

N. Y., Long Island City—Queensboro Dairy, 35 12th Ave., Astoria, soon takes bids general and separate contracts garage and office building, 41st St. and 35th Ave. $40,000. R. Shulkind, archt.

BIDS ASKED

N. J., Union City—J. G. Helmers, archt., 147 Summit Ave., bids about Sept. 15, general contract 2 story basement, brick steel garage, plain found., 14th St., for Owner, c/o architect $150,000. Noted Aug. 12.

N. Y., Jamaica—See "Warehouses."

CONTRACTS AWARDED

Mass., Lowell—Lowell Electric Light Corp., 35 Market St., 2 story, brick, steel service building, to New England Power Constr. Co., 89 Broad St., Boston. Est. $125,000. Noted Mar. 26.

SHOPS AND FOUNDRIES

PROPOSED WORK

O., St. Mary's—FOUNDRY—St. Mary's Fdry. Co. plans by Austin Co., archts. and engrs., 1611 Euclid Ave., Cleveland, 1 story, 40 x 150 ft. and 30 x 120 ft., brick, steel addition, 60 tons steel. $50,000.

CONTRACTS AWARDED

Ont., Hamilton—Steel Co. of Canada Ltd., Hamilton, reconstructing steel furnace, new skip hoist, revolving distributor, etc., to Arthur G. McKee & Co., 2422 Euclid St., Cleveland, O. and 120 Bway., New York. Est. $100,000.

POWER PLANTS

PROPOSED WORK

Ind., Crown Point—City Council soon takes bids power plant, incl. Diesel engine. Burns & McDonnell Eng. Co., 400 Interstate Bldg., Kansas City, Mo., engrs.

Ohio—See "Hospitals."

O., Cincinnati—See "Waterworks."

O., Franklin—City, power plant, project temporarily abandoned. Burns & McDonnell Eng. Co., 400 Interstate Bldg., Kansas City, Mo., engrs. Noted Mar. 19.

Pa., Ford City—City Council soon takes bids 500 kw. diesel engine for light plant. Burns & McDonnell Eng. Co., 400 Interstate Bldg., Kansas City, Mo., engrs.

S. D., Webster—Northwestern Pub. Serv. Co., E. A. Sewell, mgr., 1,120 hp. brick power plant, diesel engines. Eng. Dpt. of Owner, engrs.

BIDS ASKED

Mass., Franklin—See "Contracts Awarded."

Mass., North Wilbraham—Collins Mfg. Co., 56 Suffolk St., Holyoke, taking bids 1 story, brick, steel power house, plain found. $50,000. McClintock & Graig, 458 Bridge St., Springfield, archts. Noted July 30.

N. Y., New York—See "Contracts Awarded."

CONTRACTS AWARDED

Mass., Franklin—Union Light & Power Co., P. Poirier, supt., 25 East Central St., steel open air power station, concrete found., Peck St., to New England Power Constr. Co., 89 Broad St., Boston. Est. $200,000.

Mass., Franklin—New England Power Assn., 89 Broad St., Boston, 1 story, steel sub-station and power lines, concrete found. to New England Power Constr. Co., 89 Broad St. Est. $200,000.

N. Y., New York—New York Steam Corp., 280 Madison Ave., plant and steam pipe line additions, day labor. $2,500,000.

WAREHOUSES

PROPOSED WORK

Calif., Los Angeles—Overland Terminal Warehouse Co. (subsidiary Union Pacific R.R. Co., 1809 East 9th St.), sketches Class A warehouse, 9th and Alameda Sts. To exceed $500,000. Eng. Dpt. of Owners, engrs.

N. Y., Jamaica—General Builders & Supply Corp., 205 East 42nd St., New York, sketches 1 story, 40 x 160 ft. warehouse, 1 story, 30 x 80 ft. garage, both metal, Liberty Ave. and 177th St. Private plans.

N. Y., Long Island City — Kalbert Realty Corp., 26 Court St., plans by P. Freshman, 50 Court St., Brooklyn, 2 story storage, store and bowling alley, Fulton and 149th Sts. $100,000.

N. Y., Syracuse—New York Central R.R. Co., 466 Lexington Ave., New York, F. B. Freeman, ch. engr., freight terminal, incl. water tanks, water columns. $500,000. **Maturity later.** Private plans.

O., Youngstown—Cook & Canfield, archts., City Bank Bldg., soon lets contract 3 story, basement, 100 x 200 ft., rein.-con., brick warehouse, for Watson Terminal & Warehouse Co., W. W. Watson, pres. $200,000. Atlantic & Pacific Tea Co., Graybar Bldg., New York, lessee.

Ont., Goderich—Huron Co. Fruit Growers Assn., G. Laithwaite, pres., sketches 4 story, concrete cold storage warehouse. $100,000. E. H. Darling, 36 James St. S., Hamilton, engr.

BIDS ASKED

N. J., New Brunswick—Lewis & Leonard, archts., 51 East 42nd St., New York, taking bids (selected list contractors), general contract 7 story, basement, 50 x 100 ft., brick, rein.-con., plain found., Sanford St., for C. T. Wales, Inc., 26 French St. $150,000.

CONTRACTS AWARDED

Ont., Strathroy—Middlesex Fruit Growers Assn., A. McDougall, pres., 3 story, 55 x 130 ft., rein.-con. cold storage warehouse, to James Vance, 15 Market Sq., Woodstock. $37,000 (less heating.)

See proposal advertising on page 67